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In 1977, the United States was dependent on petroleum imports for 47 percent of its energy needs, despite the administration's effort to move toward energy independence. In 1978, as this introductory article points out, "... the nation continues to struggle with the conflicting pressures for resolving the petroleum supply-and-demand dilemma and the regulatory stalemate that underlie the energy crisis of the 1970's."

The United States Oil Industry

BY ROBERT W. RYCROFT

Compton Visiting Fellow, Center for International Studies, Princeton University

MORE than four years after the boycott by the Organization of Petroleum Exporting Countries (OPEC) ended the era of cheap and dependable oil, perhaps only two aspects of the "energy crisis" have been firmly established. First, at least for the short term (until 1985) the United States remains in the throes of what is really a "petroleum crisis." For despite the rhetoric of Project Independence and the substance of the National Energy Plan, the key short-term energy supply-demand problem continues to effect an orderly transition away from dependency on oil. Although the available energy choices range from a reliance on "business as usual" to the more radical "zero energy growth," all short-term energy strategies have three elements in common: extending, as far as possible, petroleum as a major but declining source of energy for this century; increasing the production of conventional, non-petroleum sources (coal and nuclear power, for the most part); and developing nonconventional, renewable options (such as geothermal or solar energy) for the future.

The second demonstrable aspect of the energy dilemma is that the success of these strategies depends in large part on the resolution of a "regulatory crisis." That is, the utilization of new technologies and sources for domestic energy hinges to a great degree on redefining the appropriate regulatory relationships between the federal government and the oil industry. The United States oil industry is preeminent in energy policy. As the third largest industry in the nation, with

great economic resources at its disposal, it is easily able to undertake extensive research programs and to pay the substantial costs of developing both conventional and renewable sources of energy. But these resource development advantages may also be avenues for monopolistic behavior. As a result, petroleum and its products are subjected to public controls that constrain every sector and level of the industry. Controversy has always surrounded federal regulation of petroleum firms, but in recent years the debate between proponents of "decontrol" and advocates of "breaking up big oil" have been especially visceral. And while these polemics continue to dominate, there can be no comprehensive national energy policy.

THE PETROLEUM CRISIS

A reduction in the historical American addiction to oil is necessary because this finite fuel faces an extremely uncertain future. The roots of the petroleum crisis may be found in the following factors: oil is the nation's least abundant but most preferred source of energy, and as a consequence the United States has become increasingly dependent on relatively insecure sources of oil imports. At the time of the boycott, petroleum (both domestic and imported) provided about 46 percent of all United States energy demand; by the end of 1976 petroleum's share of United States consumption had actually grown to more than 47 percent.¹ At the same time, however, new discoveries of domestic oil were not keeping pace with the rate of production. Table 1, which outlines the latest estimates of United States crude oil reserves and resources, indicates that the total proved reserves (those deposits known to be economically recoverable using currently available technologies) were about 34

¹See Robert W. Rycroft, "U.S. Energy Demand and Supply," *Current History*, vol. 74 (March, 1978), pp. 100-101.

TABLE 1: ESTIMATED UNITED STATES CRUDE OIL RESERVES AND RESOURCES, 1975
(billions of barrels)

| Supply Source | Proved | Reserves | | Undiscovered Resources | |
|--------------------|--------|-----------|----------|------------------------|------|
| | | Indicated | Inferred | High | Low |
| Lower-48, onshore | 21.1 | 4.3 | 14.2 | 60.0 | 28.0 |
| Lower-48, offshore | 3.1 | 0.4 | 2.6 | 49.6 | 15.6 |
| Alaska | 10.1 | 0.0 | 6.2 | 16.3 | 7.7 |
| Total | 34.3 | 4.7 | 23.0 | 125.9 | 51.3 |

Source: Federal Energy Administration, *1976 National Energy Outlook* (Washington, D.C.: Government Printing Office, 1976), pp. 70 and 92.

billion barrels at the beginning of 1975. This represents a decrease of about one billion barrels from the previous year and the continuation of a decline that began in 1971. Since the last major discoveries were made in Alaska in 1970, total proved reserves of domestic crude oil have declined by more than 16 percent. At present rates of production the United States has only about 10 years of proved reserves remaining. But another 4.7 billion barrels might be recoverable from known fields by using fluid injection techniques (indicated reserves). And an additional 23 billion barrels may be inferred from the combined proved and indicated reserves, though these estimates are highly speculative.

Even more uncertain are the assessments of undiscovered recoverable resources (those deposits which can only be estimated according to historical and geological data) which, according to the best available information, may be between 50 and 125 billion barrels. For perspective, this compares to the cumulative domestic oil production as of 1975 of 105 billion barrels. These resource estimates are themselves considerably more conservative than those undertaken in the 1960's, some of which predicted undiscovered resources as large as 590 billion barrels.² The greatest uncertainties associated with resources are the Alaskan and outer continental shelf (OCS) estimates, where there is little production history on which to base predictions.

Since 1970, United States production has followed the declining reserves and resources. As illustrated in Table 2, domestic oil supply was about 8.4 million barrels per day (MBD) in 1975. This represents a drop of almost one MBD in the post-boycott period. And the trend has continued; crude outputs were down 2.8 percent in 1976. Moreover, projections for short-term production are not overly optimistic. Although there is the possibility that the discovery of new fields and the extensive use of secondary and tertiary recovery

techniques (such as heat or water injections) in old fields in the Lower-48 onshore, an accelerated OCS leasing schedule, and rapidly expanding production in Alaska could double domestic supply by 1985, most experts believe this level is probably not achievable. Given the current paucity of new discoveries onshore and the delays in leasing offshore, a more likely possibility would be domestic production in the range of 10 to 12 MBD. This lower supply estimate is based on a continued decline in Lower-48 onshore resources, reserves, and production, modest increases in OCS, Alaskan, and enhanced recovery from oil fields, and no difficulties in the petroleum supply network (particularly the Trans-Alaskan pipeline).³

Even the most optimistic assessments of domestic production do not assume supply will be able to keep pace with demand. According to the information in Table 3, petroleum consumption in 1985 could be about 20 MBD. This is in line with other studies which have projected crude oil demand at between 17 and 23 MBD. These estimates are based on reducing the historical oil consumption growth rate (about 4.2 percent annually between 1960 and 1972) by about 50 percent by 1985. Most of this reduction would come from the electrical generation sector of the economy, where higher oil prices and supply uncertainties are expected to discourage any growth in the consumption of petroleum by utilities. In fact, electrical generation demand for oil should decline as coal and nuclear power plants replace many of the existing oil-fired facilities. Transportation uses, which account for more than half of all petroleum consumed in this country, should level off somewhat from their historical oil consumption patterns if higher gasoline prices and mandatory automobile fuel efficiency standards have their expected impacts. The household/commercial and industrial sectors, however, appear to be relatively insensitive to decreasing oil availability. Higher natural gas prices will likely force many consumers in the household/commercial sector to continue using oil as a source for space heating. And much oil demand in the industrial sector is inflexible because there are simply no substitute fuels for oil in many industrial processes.

The end result of petroleum demand outstripping supply has been a dramatic growth in dependency on

²See Joseph P. Riva, Jr., "Energy Supply: Oil and Natural Gas," in Herman T. Franssen, ed., *Project Interdependence: U.S. and World Energy Outlook Through 1990* (Washington, D.C.: Government Printing Office, 1977), pp. 130-180.

³See Don E. Kash et al., *Our Energy Future: The Role of Research, Development, and Demonstration in Reaching a National Consensus on Energy Supply* (Norman, Okla.: University of Oklahoma Press, 1976), pp. 243-248.

imports. According to the administration's National Energy Plan:

In 1947, the United States became a net importer of oil, but domestic excess production capacity exceeded the level of imports. By the mid-1960's, the United States had become dependent on imports: domestic excess capacity could no longer match the level of imports. Imports rose from 21 percent of U.S. oil consumption in 1965 to 37 percent in 1974. In 1976, imports averaged 7.3 million barrels per day, or 42 percent of U.S. oil consumption. In February of 1977, oil imports jumped to 9.6 million barrels per day. Increasing consumption of imported oil has led to deepening dependence on the world oil market and growing vulnerability to a supply interruption.⁴

American import dependency is especially troublesome today since about two-thirds of petroleum imports now come from outside the relatively secure Western Hemisphere. But even if import sources were more reliable, there remains the problem of the production capacity limitations on the oil-exporting nations which will limit their ability to meet global demands in the 1980's.

THE REGULATORY CRISIS

As the public has come to understand the implications of the petroleum crisis, the federal government often has been seized upon as the mode of policy access and control. Beginning with the environmental and consumer movements of the late 1960's, there has been an increasing demand for broader public participation in and management of historically private decision-making areas. The oil boycott accelerated these pressures in the oil policy system, focusing national attention on the fossil fuels that were the primary source of United States energy supplies. And in a matter of months much of the private world of the oil industry became a matter of widespread and intense public concern.

The most striking indicator of the growing reliance on the national government as a participatory and regulatory mechanism in petroleum decision-making is the proliferation of federal organizations with some measure of control over the oil industry. By 1975, more than 80 federal agencies, departments, bureaus, and commissions had a role in overseeing the activities of petroleum companies. But far more significant than the sheer volume and fragmentation of oil regulation is the broadened scope of the newer federal regulatory institutions. Until the 1970's, government control of business was fashioned after the model of economic regulatory bodies such as the Interstate Commerce Commission.

This "old-style" regulation involved a mixed inter-

⁴Executive Office of the President, *The National Energy Plan* (Washington, D.C.: Government Printing Office, 1977), p. 14.

⁵William Lilley 3d and James C. Miller 3d, "The New 'Social Regulation,'" *The Public Interest*, vol. 47 (Spring, 1977), pp. 49-51. See also Murray L. Weidenbaum, "The New Wave of Government Regulation of Business," *Business and Society Review*, vol. 15 (Fall, 1975), pp. 81-86.

TABLE 2: PROJECTIONS OF SHORT-TERM DOMESTIC CRUDE OIL SUPPLY, 1975 (millions of barrels per day)*

| Supply Source | 1975 | 1985 Estimates | |
|--------------------|--------|----------------|-----|
| | Actual | High | Low |
| Lower-48, onshore | 7.0 | 8.7 | 6.5 |
| Lower-48, offshore | 1.2 | 3.0 | 1.7 |
| Alaska | 0.2 | 4.8 | 1.7 |
| Total | 8.4 | 16.5 | 9.9 |

*Does not include natural gas liquids; assumes a \$13 per barrel price for oil.

Source: Federal Energy Administration, *1976 National Energy Outlook* (Washington, D.C.: Government Printing Office, 1976), p. 90.

TABLE 3: PROJECTIONS OF SHORT-TERM DOMESTIC CRUDE OIL DEMAND, 1975 (millions of barrels per day)*

| Demand Sector | 1974 Actual | 1985 Estimate |
|-----------------------|-------------|---------------|
| Household/commercial | 3.4 | 4.0 |
| Industrial | 3.1 | 4.2 |
| Transportation | 8.7 | 11.5 |
| Electrical generation | 1.5 | 1.2 |
| Total | 16.7 | 20.9 |

*Does not include natural gas liquids; assumes a \$13 per barrel price for oil.

Source: Federal Energy Administration, *1976 National Energy Outlook* (Washington, D.C.: Government Printing Office, 1976), p. 17.

vention/promotion role that combined the authority to monitor and manipulate the market activities of a particular industry with the added responsibility for safeguarding the healthy development of that industry. Unlike this narrow economic focus, the social controls vested in recently established agencies such as the Environmental Protection Agency (EPA), the Federal Energy Administration (FEA), and the Occupational Safety and Health Administration (OSHA) have led to much more pervasive public intervention in the private sector. The new "social regulation" involved in assuring environmental quality, fuel allocation, or health and safety goes beyond the manipulation of the general business environment of the industry to the control of the very nature of the production and distribution processes. Federal control of the conditions under which goods and services are produced and the physical characteristics of products are determined has two important impacts: more restrictions are placed on the firm, giving it fewer "degrees of freedom," and ultimately more consumers are affected than was the case under the old-style regulation.⁵

The growth of social regulation has been truly remarkable. Since 1970, over 35 significant pieces of federal regulatory legislation have been enacted. These range from the 1970 Clean Air Act Amendments to the

1977 Department of Energy Organization Act. During the period between 1970 and 1975 no fewer than seven major federal regulatory agencies were created, five of which exercise primarily social controls. This process expanded the volume of regulations by about one-third and increased government expenditures of regulatory agencies by more than 150 percent. And most of this regulation has a direct impact on the oil industry. Thus the modern oil company finds not only its economic performance controlled, but also its inputs, processes, and outputs regulated. For example, a petroleum firm operating under the social regulations must function with its economic market entry or rate of return closely supervised, its labor or raw materials managed, its production technologies governed, and its product prices and distribution subject to government rules.⁶

This is not to argue that the new social regulatory focus has been the sole factor in the increasing amount of governmental control of petroleum firms. Indeed, the changing nature of the oil industry itself has greatly contributed to the drive toward public intervention. Structural characteristics which have worked to the advantage of the industry but which have also threatened various parties-at-interest are numerous, but the most significant have been the high degree of "well-to-pump" marketing control of petroleum (vertical integration) and the diversification of holdings to include coal, uranium, and other energy resources (horizontal integration).

In large part the new social regulations reflect a widespread public view that oil supply and demand problems have their origins in just such structural peculiarities of the industry. According to the economic and political theories that underlie government regulation of business, there are three justifications for public control of any industry: to allocate externalities, to maintain effective competition, and to promote income redistribution.⁷ The rationale for federal regulation of the oil industry contains elements of all these market failures. Controls have been implemented and supported because the activities of the modern "energy corporation" are perceived as producing substantial externalities. Environmental costs are the most obvious examples of oil-induced externalities.

In addition, oil companies are often perceived as being essentially non-competitive. The level of horizontal and vertical integration that characterizes some

segments of the industry is usually cited as evidence of a low level of competitiveness. And finally, the petroleum industry is the target of regulatory efforts because it is seen as creating massive income redistributions through "windfall" profits and other pricing manipulations.⁸ Determining the degree to which these perceptions are justified requires a more detailed description of each of these aspects of oil industry structure and behavior.

OIL INDUSTRY EXTERNALITIES

The oil industry generates many costs that are transferred to the society rather than absorbed by the oil companies themselves. Many petroleum production processes, for example, result in the creation of hazardous materials that may be threats to worker and community health and safety. But the most controversial oil industry externalities have been the environmental costs associated with OCS and Alaskan oil development and petroleum transportation and distribution activities.

Only in the last decade or so have environmental externalities become important considerations in the relationship between the public and the oil industry. Just as the increasing demand for oil has encouraged the industry to expand its operations toward economically marginal deposits, so has the consumption stimulus introduced oil activities into environmentally marginal regions. Thus, oil companies increasingly are involved in very high-cost, high-risk development in "frontier" regions. Areas such as Alaska and the deep OCS not only demand stricter performance standards because of their "pristine" nature, but these remote regions often require extensive and hazardous transportation linkages to centers of consumption. Offshore petroleum development has been particularly significant in this regard; in recent years the oil companies have made major investments in OCS leases and development technologies. And, as was discussed above, a substantial portion of domestic crude oil production (about 14 percent in 1975) now comes from offshore sources.

At the same time, however, the development of OCS resources has been a tremendous catalyst for the environmental movement and for the imposition of environmental quality controls. Ecological disasters such as the 1969 Santa Barbara oil spill dramatically altered American public opinion regarding the environmental risks posed by offshore oil. Thus, polls conducted between 1965 and 1970 showed sharp increases in the public's perception that the oil industry was one of the industries most responsible for water pollution.⁹ Offshore facilities did indeed contribute over 25 percent of the total volume of oil spilled in and around United States waters in 1970; OCS operations accounted for some 93,000 barrels out of a total of over 360,000 barrels spilled that year. But OCS facility spills decreased dramatically in 1971 and 1972 as a result of

⁶Robert A. Leone, "The Real Costs of Regulation," *Harvard Business Review*, vol. 55 (November-December, 1977), pp. 57-58.

⁷Walter J. Mead, "Petroleum: An Unregulated Industry?" in Robert J. Kalter and William A. Vogely, eds., *Energy Supply and Government Policy* (Ithaca, N.Y.: Cornell University Press, 1976), pp. 131-132.

⁸See Sheldon Novick, "The Fuel Industry," *Environment*, vol. 18 (October, 1976), pp. 13-16 and 25-27.

⁹Hazel Erskine, "The Polls: Pollution and Industry," *Public Opinion Quarterly*, vol. 36 (Summer, 1972), pp. 268-269.

tighter accident prevention measures imposed by the industry and stricter environmental pollution controls following passage of the National Environmental Policy Act and subsequent federal water quality legislation.¹⁰

As the OCS leasing debate has evolved, many of the technical and scientific issues have been replaced by the political and economic implications of environmental externalities. State and federal governments, for example, have engaged in a lengthy debate over how to assure compensation in case of environmental damage from offshore development. Nevertheless, the leasing process appears to be working again (for instance the recent sale of more than one million acres off the Southeast Georgia Embayment) and with less concern about environmental impacts. In short, despite their obvious costs in terms of time and money, social controls appear to have been relatively successful in resolving OCS oil development conflicts. In fact, the reliability and credibility of the information generated by the offshore petroleum debate is often cited as a model case for reaching political accommodations in energy policy. On the other hand, the discovery of safety problems with the Trans-Alaskan pipeline and a series of spectacular tanker spills throughout 1976 and 1977 signaled to many participants the necessity for greater federal intervention in oil transportation. The environmental damage from accidents such as the recent spill of 29 million gallons of petroleum by the tanker *Amoco Cadiz* off the coast of France almost guarantees that transportation activities will receive greater federal regulatory attention in the short-term future.

OIL INDUSTRY COMPETITION

Since the attempts to dissolve the Standard Oil "trust" in the early 1900's, the noncompetitive aspects of concentrated control of oil reserves, production, refining, retailing and transportation activities by "vertically integrated" petroleum firms have been a central public concern. But while there has always been public fear of and hostility toward the alleged monopolistic tendencies of the oil companies, the critical fuel shortages of 1973 generated perhaps an all-time high level of public suspicion that an energy crisis was an industry contrivance. Public opinion polls indicated that Americans tended to blame the companies even more than the Organization of Petroleum Exporting Countries for the long lines at gasoline pumps.¹¹

These perceptions were reinforced by a number of

¹⁰See Don E. Kash et al., *Energy Under the Oceans* (Norman, Okla.: University of Oklahoma Press, 1973), pp. 275-282.

¹¹See Anthony Sampson, *The Seven Sisters: The Great Oil Companies and the World They Shaped* (New York: Viking Press, 1975), pp. 311-338.

¹²Federal Trade Commission, *Preliminary Federal Trade Commission Staff Report on Its Investigation of the Petroleum Industry* (Washington, D.C.: Government Printing Office, 1973), pp. 12-31.

TABLE 4: CONCENTRATION RATIOS FOR MAJOR SECTORS OF THE OIL INDUSTRY, 1955-1972

| Sector | Percentage Accounted for by the Largest 4 Companies | Percentage Accounted for by the Largest 8 Companies |
|----------------------|---|---|
| Crude Oil Reserves | | |
| 1970 | 37.2 | 63.9 |
| Crude Oil Production | | |
| 1955 | 18.8 | 31.1 |
| 1970 | 30.5 | 50.1 |
| 1972 | 29.4 | 46.9 |
| Petroleum Refining | | |
| 1955 | 32.8 | 57.5 |
| 1972 | 31.0 | 56.0 |
| Gasoline Sales | | |
| 1954 | 31.2 | 54.0 |
| 1972 | 29.0 | 51.6 |

Source: William A. Johnson et al., *Competition in the Oil Industry* (Washington, D.C.: Energy Policy Research Project, The George Washington University, 1975), p. 3.

negative evaluations of the competitiveness of the petroleum industry, the most influential of which was a 1973 Federal Trade Commission (FTC) report on the role of oil companies in the development of fuel shortages. According to the FTC, the industry was dominated by 18 vertically integrated firms that operated in all stages of oil resource development.¹² And the FTC noted a "clear trend toward greater concentration" and a complex and growing set of barriers to market entry that had the effect of "squeezing out" independent firms. Analyses such as this were instrumental in generating public pressures for federal intervention into the marketing activities of the major oil companies: the Federal Energy Administration was one obvious response to this perceived threat to petroleum competition.

The FTC report triggered a flood of contradictory assessments of oil industry competitiveness, but on some aspects of the vertical integration issue there is agreement. The most commonly utilized measure of industry competition is the concentration ratio, which indicates the percentage of a certain industrial activity controlled by the largest firms. The higher the level of concentra-

(Continued on page 225)

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"Even if the American economy could continue to handle the oil import bills caused by undiminished demand growth rates, the ultimate issue confronting the private consumer, at home and everywhere abroad, is that oil and natural gas are finite resources."

The Private Consumer and Energy Conservation

BY DOROTHEA H. EL MALLAKH

Associate Editor, Journal of Energy and Development

SINCE 1973, which was a critical watershed vis-à-vis United States and world energy problems, socioeconomic elements and priorities have been subjected increasingly to scrutiny both by individuals and, collectively, by government and industry; new economic realities are leading to a reordering of priorities.¹ The year 1973 witnessed severe supply constraints in international petroleum because of the Arab oil embargo initiated that autumn, coupled with an increase in the posted price of Organization of Petroleum Exporting Countries (OPEC) oil from \$2.90 to \$11.65 per barrel in about a six-month span, from June 1, 1973, to January 1, 1974. The combination of scarcity in oil products and radically higher prices for those products served to rivet the attention of the American public on energy, jolting heretofore unthinking consumers into recognition that their long-standing supply of sufficient, low-cost energy was being challenged, if not irrevocably altered.

The dissemination of information is one of the major objectives in the battle against excessive energy consumption. Distribution of statistics and data to private consumers is an absolute requirement if consumers are to respond rationally. Thus, before we can decide what directions are open to us—collectively and as individuals—in the area of energy conservation, we should first know where we actually are.

Tables 1 through 5 offer some basic data on the

¹An excellent overview of the challenge facing the private consumer is offered in Joel Darmstadter, "Conserving Energy: Issues, Opportunities, Prospects," *Journal of Energy and Development*, Autumn, 1976, pp. 1-2.

²United States, Library of Congress, Congressional Research Service, *Project Interdependence: U.S. and World Energy Outlook through 1990*, publication no. 95-31 (Washington, D.C.: Government Printing Office, June, 1977), p. 11. For comparative purposes, in 1976 Americans had the highest barrels per capita consumption of petroleum products (excluding aviation fuels and ocean bunkers) in the world, 26 barrels per person. Next in order were Canada, 25 barrels; Sweden, 24 barrels; West Germany, 16 barrels; Japan and France, 15 barrels each; United Kingdom, 10 barrels; and India, 0.3 barrels per person. Shell International Petroleum Company Limited, *Information Handbook 1977-78* (London: Shell International Petroleum Company Limited, 1977), p. 57.

pattern of United States energy consumption in relation to the total global picture.² Conservation in the importing, consuming countries is primarily viewed from the demand rather than the supply side; on the other hand, an oil-exporting nation speaks of conservation in terms of keeping production down in an effort to maximize the effect of exploitation of the resource. There is a general consensus that the shares of the various energy sources (the fossil fuels of coal and oil and natural gas; nuclear; hydro; and solar) in total energy supply will not reflect any drastic changes in the next 15 to 20 years. Thus conservation of those sources on which we now rely most heavily—that is, the nonrenewable fossil fuels—is clearly an effective means of reducing present usage to expand the life span of these resources. This, in turn, would facilitate the transition to other energy sources without undue pressure and cost.

American energy consumption has been rising steadily, with the largest growth in fossil fuels, specifically, oil and natural gas (see Table 1). In 1966, oil's share in total energy consumption was just over 47 percent; a decade later, its contribution had risen to over 51 percent. In the same span, the share of natural gas increased from 16 percent to 19 percent; coal's contribution declined from 28 percent to about 19 percent; hydro similarly fell from 8 percent to just over 7 percent; and nuclear energy accounted for 0.4 percent in 1966 and 2.4 percent of total energy consumption in 1976. With the depleting fossil fuels of oil and natural gas presently filling some 70 percent of our energy requirements, the manner in which these sources are used becomes critical. Worldwide, the transportation sector is the largest single consuming sector (see Table 2). And next to petrochemical feedstocks, it is most difficult to find substitutes for oil in internal-combustion engines.

Table 3 offers a comparison of consumption patterns in the transportation sectors of different nations. The private auto is, of course, the largest user of gasoline; 45 percent of the total petroleum product consumption in the United States in 1976 was gasoline. Of the remaining statistical data, Table 4 presents some forecasts on the sectoral importance of transportation and other end users of energy in the United States. The rate

**TABLE 1: NON-COMMUNIST WORLD'S
COMMERCIAL ENERGY CONSUMPTION^a**
(in million of barrels per day of oil equivalent)

| | 1966 | 1975 | 1976 |
|---------------------|------|------|------|
| Petroleum fuels | 26.8 | 42.4 | 42.5 |
| Natural gas | 9.2 | 15.2 | 16.0 |
| Solid fuels | 15.7 | 15.8 | 16.0 |
| Hydroelectricity | 4.6 | 5.8 | 6.0 |
| Nuclear electricity | 0.2 | 0.9 | 2.0 |
| Total | 56.5 | 80.1 | 82.5 |

^aThis designation excludes the U.S.S.R., Eastern Europe, and China.

Source: Shell International Petroleum Company Limited, *Information Handbook, 1977-78* (London: Shell International Petroleum Company Limited, 1977), p. 54.

**TABLE 2: NON-COMMUNIST WORLD'S
CONSUMPTION OF PETROLEUM PRODUCTS, 1976**
(in million of barrels per day—b/d)

| | |
|-------------------------|------|
| Motor gasoline | 12.2 |
| Aviation turbine fuels | 1.9 |
| Kerosine | 1.4 |
| Gas/diesel | 11.0 |
| Fuel oil | 12.6 |
| Lubricants | 0.4 |
| Bitumen (e.g., asphalt) | 1.0 |
| Others | 5.9 |
| Total | 46.4 |

Source: Shell International Petroleum Company Limited, *Information Handbook, 1977-78*, p. 55.

TABLE 3: NON-COMMUNIST WORLD'S CONSUMPTION OF SPECIFIC PETROLEUM PRODUCTS
(as % by volume of total petroleum product consumption)

| Product | United States | United Kingdom | France | Japan | India |
|--------------------|---------------|----------------|--------|-------|-------|
| Gasolines | 45 | 31 | 23 | 23 | 18 |
| Kerosines | 6 | 8 | 2 | 9 | 19 |
| Gasoil/diesel fuel | 19 | 23 | 37 | 13 | 34 |
| Fuel oil | 16 | 32 | 30 | 46 | 21 |
| Others | 14 | 6 | 8 | 9 | 8 |
| | 100% | 100% | 100% | 100% | 100% |

Source: Shell International Petroleum Company Limited, *Information Handbook, 1977-78*, p. 55.

of growth in energy use by the various sectors has not been uniform; the industrial sector accounted for some 40 percent of American energy demand in 1950 but about one-third in 1975, 25 years later. On the other hand, demand in the transportation and residential/commercial sector increased from 25 percent each in 1950 to approximately one-third each in 1975; the trend toward greater consumption by these two sectors resulted largely from changing use patterns rather than from lessened efficiency.

Estimates of the annual average growth rates in energy consumption by sectors to 1985 are based on the assumption that the provisions and programs presented by President Jimmy Carter in his National Energy Plan (NEP), still before the Congress, will be implemented (see Table 5). The NEP envisages a strong role for conservation and large decreases in the residential/com-

³Estimates on future consumption vary; however, those in Table 5 fall well within the range of generally accepted forecasts.

⁴Rene Zentner, "The Myth of Energy Conservation," in *Energy Options and Conservation*, proceedings of the Fourth International Conference, University of Colorado, October 17-19, 1977 (Boulder, Colorado: International Research Center for Energy and Economic Development, forthcoming, 1978).

⁵A more detailed analysis of goals and obstacles in conservation is offered in Dorothea H. El Mallakh, "Energy Options and Conservation," *Current History*, March, 1978, pp. 113-16.

mercial, electric utility, and transportation sectors for the years covered in the plan (1976-1985); it is estimated that industry will double its 1950-1976 growth rate during the plan period.³

A few final statistics. By 1974, there were approximately 77 million units of residential housing stock in the United States. About half of these were air-conditioned and less than 1 percent were unheated. These units, moreover, had cooled and heated large rooms with relatively modest insulation. There were over 92 million cars and 23 million trucks in use in the United States during that year, while almost 60 million Americans commuted to work by private car.⁴

THE PROS AND CONS OF CONSERVATION

Conservation is apparently the most rational approach to dampening demand.⁵ Yet there are many obstacles to meaningful conservation in the United States, some easily quantifiable and others of a qualitative nature. The essence of successful conservation is the meshing of expectations with what can be achieved realistically within a certain time. Some conservation efforts can be implemented with relative speed by the individual consumer, causing little disruption to life style and stimulated by definable economic advantages. We would all benefit from a lower level of air pollution caused by automobiles; we would all respond to the

TABLE 4: UNITED STATES DEMAND FOR ENERGY: 1976-90, REFERENCE CASE
(in quadrillion Btu)^a

| Demand by Sector | 1976 | 1985 | 1990 |
|---|------|------|-------|
| Final demand: | | | |
| Household and commercial | 14.7 | 13.7 | 15.3 |
| Industrial | 18.5 | 25.3 | 29.4 |
| Transportation | 19.3 | 21.6 | 22.7 |
| Subtotal | 52.5 | 60.6 | 67.4 |
| Intermediate demand: electric utilities | 21.5 | 34.2 | 41.5 |
| Gross energy demand | 74.0 | 94.8 | 108.9 |

Different expressions of energy measurement are widely used in present literature. One quad (or 1 quadrillion Btu-British thermal units) is also expressed as 10^{15} Btu. For conversion purposes, 2.1×1 quad = 1 million barrels per day of oil equivalent. Moreover, 1 million b/d of oil equivalent (1 mbdoe) is equal to: 50 million tons of oil equivalent (toe) per year; 76 million metric tons of coal equivalent (tce) per year; 57 billion cubic meters of natural gas per year.

Source: United States, Library of Congress, Congressional Research Service, *Project Interdependence: U.S. and World Energy Outlook through 1990*, publication no. 95-31 (Washington, D.C.: Government Printing Office, June, 1977), p. 13.

TABLE 5: UNITED STATES ENERGY USE FORECASTS IN 1985 WITH IMPLEMENTATION OF NATIONAL ENERGY PLAN

| Sector | Average Annual Growth Rate (in %) | | | | |
|------------------------------|-----------------------------------|---------------|---------------|---------------|---------------|
| | Plan 1976-85 | 1950- 1976 | 1960- 1976 | 1950- 1973 | 1960- 1973 |
| Residential/commercial | 1.1 | 4.0 | 4.2 | 4.2 | 4.7 |
| Transportation | 1.1 | 3.1 | 3.7 | 3.4 | 4.3 |
| Industry | 4.6 | 2.3 | 2.3 | 2.95 | 3.3 |
| Electricity | 4.4 | 7.1 | 5.9 | 7.7 | 6.6 |
| Total energy | 2.55 | 3.0 | 3.2 | 3.5 | 4.0 |

Source: United States Congress, Office of Technology Assessment, *Analysis of the Proposed National Energy Plan* (Washington, D.C.: Office of Technology Assessment, June, 1977, prepublication draft), p. 104.

lower utility bills that would result if we were to install better insulation in our homes, either simple weather-stripping or more extensive upgrading of attic and wall insulation.

If, for instance, the consumer believes that high utility prices are only transitory, then he will lack a strong economic motivation for conservation or investment in conservation projects. Information and attitudes

^aAlthough the American consumer was faced with a near doubling in the price per gallon of gasoline, the retail price for this product in the United States remains one of the world's lowest. As of July, 1974, retail prices for regular gasoline (in U.S. dollars per U.S. gallon) elsewhere were: France-\$1.318; Germany-\$1.265; India-\$1.747; Italy-\$1.69; Japan-\$1.361; Norway-\$1.47; United Kingdom-\$1.25. *International Petroleum Encyclopedia 1975* (Tulsa, Oklahoma: The Petroleum Publishing Company, 1975), p. 313. Norway, with its North Sea oil and gas holdings, is a net exporter of energy, yet its gasoline price reflects the international petroleum price level. Gasoline prices in Europe already were hovering around the \$1 per barrel mark almost two decades ago; this clearly aided the acceptance of smaller cars in Europe. In April, 1978, the retail price per gallon of gasoline in the United States ranged between about 52.9¢ to 65.9¢ per gallon (lead-free slightly higher, 55.9¢ to 64.9¢).

become critical here. After the abrupt dislocations in 1973 and early 1974 in petroleum supply and prices, many sought a scapegoat, blaming OPEC or the oil companies or the government. It was charged that the shortage was contrived, or that OPEC would disintegrate and low-cost oil would return, or that the American government had overregulated, underregulated, or otherwise mismanaged the oil industry and the national energy policy through bungling and political motives. Scapegoatism reduced the feeling of crisis. Nor did the price rise reduce consumption; Americans apparently adjusted to the higher prices, particularly for motor gasoline.⁶

As cases in point, energy consumption in the residential/commercial sector was 26,525 quads in pre-embargo 1973; in 1976, it reached 27,276 quads with a return to the historical growth rate, despite a slight decline in the two intervening years due to global recession. The transportation sector tells a similar tale: 18,877 quads of energy use in 1973 and 19,268 quads in 1976. Significantly, United States motor gasoline demand (reflected in the transportation sector) declined in 1974 but by the following year it had resumed a positive growth rate and had even exceeded the pre-

embargo demand level.⁷ In short, the American consumer seemed to dismiss the lessons of 1973-1974 lightly.

With the individual, national and international benefits of conservation obvious, one wonders why the United States does not have a better track record. Perhaps the largest factor contributing to this poor performance is the fact that major conservation is time consuming. In recent years, there has been a trend toward electric space conditioning, larger homes, more appliances, two-car families, and more energy-intensive auto options. In 1974, nearly half the new houses used electrical heating and/or air-conditioning; at least two-thirds of the cars produced were air-conditioned, with automatic transmission and power steering among other "extras." The American consumer now has extensive capital invested in this fixed stock. Houses take 40 years or more to phase out; car turnover is at least 10 years; industrial equipment and household appliances also take years for replacement.⁸ All in all, the negative position on conservation is that it will take time; if, let us say, there were drastic, involuntary, government-forced conservation in the United States, it would probably lead to considerable economic dislocation, and potentially serious political and social repercussions.

The individual consumer will respond best if he is made aware of the critical and long-term nature of the overall energy issue; if he is informed of the energy consumption requirements of the items in which he is investing, be it a television, refrigerator, car, or home; if he is offered alternatives that do not involve sizable economic or convenience dislocations, i.e., improved mass transit, home insulation retrofitting; if there are public and private sector economic incentives supporting longer-range as well as short-term undertakings as, for example, free advice on and inspection of home insulation, significant income tax deductions for energy-saving expenditures and improvements in homes and business establishments that might not be made or considered economically unwise.

In fashioning a conservation program, the major priorities may be defining what are realistic targets for a specific period; finding the best mix of public and private sector involvement—what the government should handle and what is best left to private efforts; what mix of voluntary and involuntary programs is

most effective; and what mix of incentives and disincentives could be employed.

THE PRIVATE CONSUMER'S GREATEST EFFECTIVENESS

Individual conservation effort is most significant in the transportation and residential/commercial sectors. As noted earlier, both these sectors showed consumption patterns that rebounded from the embargo-recession period (energy use in these sectors during 1976 exceeded that of 1973). The residential/commercial usage can be and is affected by newer building codes, by the retrofitting of existing structures, by simply turning down the thermostat several degrees, by better energy efficiency in hot water heaters, refrigeration units, and other household appliances, and by adjusting the lighting level of commercial establishments, among others. Rising utility rates and higher prices for fuel oil along with outright natural gas and coal shortages in the winters of 1976-1977 and 1977-1978 have stirred awareness of the seriousness of the energy supply problem and the economic benefits directly accruing from lower demand or usage. The fuels most directly involved in this sector are natural gas, coal, fuel oil, and propane (or bottled) gas; the electricity consumed is generated by coal, oil, hydro, or nuclear power. And the residential consumption pattern has been affected by the design of our cities, suburbs, and other land-use decisions. Larger urban centers with higher population densities, mass transport systems, apartments rather than single-family dwellings, and compact shopping areas are far more energy-efficient than the suburbs.⁹

This brings us to the transportation sector. For many years the unofficial symbol of the United States could easily have been the automobile. The automobile has had tremendous ramifications on all levels of national life. The car and truck have fed suburban sprawl and have brought massive city, state, and federal investment in the highway systems. At the same time, they have dampened investment in or expansion of alternative transport means like trains, buses, subways, and even water-borne movement; they have encouraged the siting of plants and industrial facilities based on low transport costs for the finished products and/or on the fact that workers could commute. In many countries, even taxi sharing is widely accepted and practiced; this rarely occurs in the United States.

WHAT IS BEING DONE?

In fact, saving energy is making strides in the United States. Car efficiency, which had declined from a 1950 average of about 15 miles per gallon (mpg) to a 1974 average of about 13.7 mpg, is again on the rise.¹⁰

(Continued on page 226)

Dorothea H. El Mallakh is associate editor of the *Journal of Energy and Development*.

⁷Zentner, *op. cit.*

⁸United States, Library of Congress, Congressional Research Service, *op. cit.*, p. 11.

⁹New York City and its environs offer an example of the relationship between rapidly rising energy consumption in the transportation sector and continuously declining population density. The range moves from about 9,000 Btu's per dollar of income in the center of the city to some 33,000 Btu's at the periphery of the 31-county region. Joel Darmstadter, *op. cit.*, p. 5.

¹⁰Zentner, *op. cit.*

"The oil companies . . . kept the peace in international oil markets for 50 years, but had apparently lost their touch. The change in image, rather than any objective transformation, has placed the international oil companies (both majors and independents) in serious trouble."

The Role of the International Oil Companies

BY RICHARD E. BISSELL

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THE international petroleum companies have had an exciting hundred years, but they resemble dinosaurs more and more as the years pass. Today their future is indeed in question, undermined by nationalism abroad, the growth of government regulation at home, and an increasingly aware and hostile public everywhere.

Most insights drawn from an analysis of the famous "seven sisters"¹ that pioneered multinational petroleum operations have been generalized to include the smaller independent international operators. The five oil companies that comprise the American component of the seven sisters accounted for about half the sales and profits of American fuel companies in 1977;² yet there is also a large and diffracted sector of "independents." Both sections of the petroleum industry have unique problems and characteristics; the financial size of the majors does not mean that they determine the shape of the industry. The American contribution to international oil reflects many diverse sources.

Clear historical trends have affected the emergence of the majors. Their original efforts to undertake overseas production in the late nineteenth and early twentieth centuries can be read as the greatest adventure stories of modern times.³ The oil explorers ventured into and settled in areas untouched by the colonists of Britain and France in the preceding three centuries, particularly in the Middle East. And when the oil companies were successful in their efforts to establish working relations

with local rulers, the oilmen found that the interests of Western governments were involved. In some cases, the oil companies asked for government intervention in order to support their claims to the oil resources; in other cases, the European governments involved themselves in what would otherwise have been commercial transactions. Throughout the history of the industry, oil and politics have been mixed.

Vertical integration in the international oil industry developed in the earliest days of the industry. The successful model of John D. Rockefeller's Standard Oil Company, which owned its processes from wellhead to refinery to gas pump, led other marketing companies in the United States and abroad to seek their own raw material sources. That search, in turn, implied the creation of shipping companies and refining operations. Within a short time, there were innumerable oil companies, large and small, competing for the opportunity to produce oil in distant lands.

At the same time, the geology of oil production meant that not all the companies could take oil from the known fields. If several competitive companies are drawing oil from the same field, each will attempt to take out the maximum quantity in the shortest time—which damages the oil deposit and reduces the long-term yield for all interested parties. Early in this century, therefore, the companies began to develop agreements, formal and informal, that would increase the long-term yield of the oil fields at the expense of short-term competition.

There were financial incentives to cooperation as well. Demand for oil tends to evolve gradually upward over time, but new fields come on stream (i.e., begin production) with a dramatic surge. The small independent driller is not concerned with those surges, since he explores and then sells the production to marketing companies that must absorb the headaches of unbalanced supply/demand. Major retail companies have therefore searched for "orderly marketing arrangements," which from the oil industry's perspective allow for smoother sales and profit figures, instead of the boom-and-bust experiences of the early industry.

¹The seven sisters, the major vertically integrated multinational oil companies, include Standard Oil of California (Socal), Texaco, Exxon, Gulf, Mobil, British Petroleum, and Royal Dutch Shell; all but the last two are American-controlled. For a colorful account of their histories and operations, see Anthony Sampson, *The Seven Sisters* (New York: Viking, 1975).

²Sales for Socal, Texaco, Exxon, Gulf, and Mobil in 1977 amounted to \$160 billion (out of an industry total of about \$300 billion) and profits were \$6 billion (industry total \$12 billion). See *Business Week*, March 20, 1978, p. 100.

³See, e.g., the biography of Nubar Gulbenkian by R. Hewins, *Mr. Five Per Cent* (London, 1957), or Marian Kent's *Oil and Empire: British Policy and Mesopotamian Oil, 1900-1920* (New York: Barnes and Noble, 1976).

Thus the seven sisters gradually emerged over time as the principal American and European oil agents in overseas-producing areas. Each had unique leverage (political and economic) that allowed it to threaten the others with a glut of production. For their survival, and to keep others out of their producing areas, the major oil companies formed intercompany arrangements sometimes known as cartels. In Saudi Arabia, for example, a new company was formed by American oil companies competing for production, and Aramco monopolized Saudi oil until the Saudi government itself decided to take control in the late 1960's. There were agreements between oil companies to remain within national boundaries in exploration activities—thus the Americans dominated Saudi Arabia, an American consortium (known as Caltex) of Texaco and Standard Oil of California dominated Bahrain, Gulf Oil and British Petroleum operated in Kuwait.

The natural economic pressures of the oil industry to centralize, then, have always existed, and these pressures have been offset by two major forces—the economic role of the independents and the political role of governments—both dedicated to limiting the centripetal tendencies of the industry.

INDEPENDENT PRODUCERS

The independent oil men have never been driven out of the industry entirely, even though their strength has fallen or risen over time. With American encouragement to gamble and explore, the independents have always been a strong domestic force. Cultural and economic factors work together to ensure the survival of cowboys searching for “black gold,” whether in Texas, the overlift belt of the Mountain States, or in Alaska. Tax writeoffs and depletion allowances allow operators to undertake such financial gambles, and outside investors are willing to put up risk capital on the long-shot chance of making a fortune. The independents have also operated abroad, wherever local governments allow non-traditional producers; the number of these governments is on the rise. In Libya, for instance, the then-tiny Occidental Petroleum took the gamble of developing its fields in the 1960's. The bet was won, largely because world consumption spurted upward far faster than predicted and cross-Mediterranean transport costs were small, allowing the Libyan crude to find a market and Occidental Petroleum to become a major factor in oil production.

Independents also engage in a large amount of “wildcat drilling,” i.e., exploring areas that have never been drilled on the basis of positive seismic tests that indicate possible commercial fields. The rate of success on wildcats is around 1 to 10. Yet the independent wildcat driller has found the major fields of the world and has then sold the rights to an established marketing major to go through the “routine” of drilling enough wells to bring the field into commercial production. Overall

pressure, however, tends to drive the wildcat driller out, not by conspiracy, but because most major fields appear to have been found. Future exploration will involve minor extensions of present fields or exotic approaches to offshore drilling (hardly within the cost and technical capabilities of wildcatters). Thus more drillers are eliminating independent activity and are taking contract work from the oil companies.

At the same time, the major oil companies are losing ground to political controls. Through the Organization of Petroleum Exporting Countries (OPEC), which has been able to raise the price of oil from \$2.00 to \$13.50 per barrel, national governments (primarily in the Middle East) have been able to control international oil companies. The last five years have also seen the progressive nationalization of oil production facilities in most OPEC countries. For the most part, the oil companies do not own the fields or the production rigs in third world areas anymore. The governments own the operations through a government-controlled oil company and pay the foreign oil multinationals (like the majors) to operate the fields. In some cases, the transition was remarkably easy. Where the oil companies had set up a cartel-like arrangement, like Aramco in Saudi Arabia, the government simply nationalized the shareholdings of Aramco. In other countries, like Nigeria, the government set up a holding company to take a controlling interest (between 55 percent and 100 percent) in the foreign operations in the country. Those companies that refused found their concession agreements revoked. The threatened loss of supplies would not have provided significant leverage in the 1950's or 1960's; but by 1970, American imports of oil were accelerating upward, and the Western oil companies lost their ability to resist pressure from OPEC governments. They needed oil to meet the skyrocketing demand in the United States, and there was no common negotiating front of the companies vis-à-vis the OPEC governments.

Subsequently, the public became involved in energy debates and, by and large, the oil companies have emerged as villains in the public perspective. The loss of public confidence in the oil companies was gradual, with a sudden drop occurring at the time of the 1973 embargo. Americans did not enjoy waiting in long lines at gasoline pumps on every other day to enjoy their “right” to drive. The oil companies had kept the peace in international oil markets for 50 years, but had apparently lost their touch. That change in image, rather than any objective transformation, has placed the international oil companies (both majors and independents) in serious trouble. For that reason, we must deal with the real and the perceived status of the oil companies.

OIL COMPANIES AT WORK

Given these pressures on the oil companies, what is their present function? There have been major changes

in the roles of large and small oil companies over the last 10 years.

Over the last five years, the companies have seen their revenue figures soar. In terms of gross revenue, the largest oil companies rank among the world's largest corporations; indeed, their revenues frequently rank with the gross national products of many middle-sized countries. Consider, for example, Texaco, the third largest American oil company. In 1977, its revenue was over \$28 billion, about the same as Indonesia's gross national product. However, Texaco's net profit was only about \$930 million in 1977, partly because Texaco was paying \$10 a barrel in taxes to host governments. Thus, Texaco and the other oil companies are functioning, to a large degree, as tax collectors for the countries where the oil is produced. The fact that OPEC nations ran a \$40 billion surplus in 1977 was due to the efficient collection of petroleum "taxes" by the oil companies.

The function of the oil companies as tax collectors is the source of some controversy. It has serious implications for the American tax liability of the companies—the United States government regards payments to producing countries as taxes, not as production expenses, and thus the tax load is reduced. Reformers urge that such payments be considered ordinary expenses, a move strongly opposed by the oil companies. Historically, the oil companies have a point; where they once paid ten cents per barrel in taxes to the host governments, they now pay ten dollars. The tax status of those payments to foreign governments may be the subject of a congressional decision in the near future.

A broader question, however, derives from the behavior of the oil companies when the price of oil made its dramatic jump upward in 1973-1974. Did the oil companies resist the increase in production taxes charged by host governments in the manner expected by American consumers who believed that oil companies should exert every effort to keep the price as cheap as possible? Some observers argue that the companies failed and should not represent the American consumer in negotiations with OPEC governments. In effect, they argue, the companies are multinational, indeed, so multinational they represent the interests of foreign countries rather better than their principal customers, American energy users. Defenders of the oil companies emphasize the environment in which oil companies were dealing with OPEC in 1973-1974: there was little American political power supporting the companies in the Watergate and post-Vietnam periods; demand was rising far faster than discovery of new reserves, giving suppliers the upper hand; and the industry itself was being fractured, as independents moved into territory formerly kept orderly by the majors, e.g., Occidental Petroleum in Libya.

⁴Vivian Lewis, "Europe's Oil Embroglio," *The New York Times*, March 26, 1978, p. 1, financial.

The last point was a critical one for the maintenance of dominance by the industry. Table 1 indicates some gross numbers:

TABLE 1: OIL COMPANIES IN THE MIDDLE EAST

| | 1940 | 1950 | 1960 | 1974 |
|-------------------|------|------|------|------|
| "Major" | 7 | 7 | 7 | 7 |
| U.S. Independents | 0 | 10 | 18 | 34 |
| Foreign Companies | 2 | 2 | 6 | 58 |

Source: Derived from United States Congress, Senate, Committee on Foreign Relations, *Multinational Corporations and United States Foreign Policy, Hearings*, part 7, before the Subcommittee on Multinational Corporations of the Committee on Foreign Relations, Senate, 93rd Congress, 2d session (Washington, D.C.: Government Printing Office, 1974), p. 352.

When a number of independents began to seek sources of oil in Indonesia, Libya and Nigeria in the 1960's, the governments were able to demand better terms from the independents than from the majors. The position of the independents was weaker; thus they tended to compromise on price negotiations. In that way, the solid front of the majors was broken, and the OPEC governments obtained the upper hand.

With regard to meeting American and West European demand, the companies found pressures hard to resist. Consumers had remarkably inelastic tastes for energy, and companies already felt under enough political pressure at home, without adding a company-induced shortage of gasoline and petroleum products. The peak of economic expansion came in 1973, and every ounce of petroleum was apparently needed. American companies were not alone in feeling the pressures from consumers and governments. A major split developed between Prime Minister Edward Heath of Great Britain and the British Petroleum (BP) company over BP shipments of oil to Holland during the 1973 embargo. It has been said that Heath was so bitter about oil diverted from Britain to Holland by a British company that he deliberately cut BP out of subsequent exploration action in the North Sea fields. The British have thus founded the government-run British National Oil Company to handle the North Sea operations instead of relying on private enterprise.⁴ In BP's view of the 1973 situation, they had an obligation to Dutch consumers as well as to British consumers, and the embargo burden had to be shared. The oil companies fared no better in the United States. If there had been any political strength in Washington, D.C., to mobilize American public opinion against the OPEC price rise, demand could have been moderated, and the companies might have believed that they had a mandate to resist price increases. That political will was absent.

The continuing political support for the oil companies was never so keenly felt as when it disappeared

in 1973. There had been episodes of American political interference, including the Central Intelligence Agency (CIA) coup against Iranian Prime Minister Muhammad Mossadeq, in 1953, because of his plans to nationalize the oil companies and to initiate a pro-Soviet foreign policy. But by and large, political support from Washington was invisible and perhaps was only potential. When that support disappeared entirely, the companies were helpless.

The effect of the 1973 OPEC embargo against the Netherlands and the United States ultimately proved most damaging to the oil companies in terms of structural changes. The confidence of the oil industry was their ultimate downfall. The companies have long enjoyed informal arrangements for swapping cargoes of oil. No formal agreements exist for this procedure, but relevant shipping officers in the industry know one another well enough to be able to call up one another and suggest swapping cargoes in order to shorten shipping routes. Thus, if Occidental plans to ship some Libyan crude to California but then discovers that Union Oil has a cargo of Indonesian crude destined for Europe, they will informally agree to swap oil, assuming that the respective oil conforms to refinery specifications (like viscosity and sulfur) at each destination.

These informal swapping arrangements were utilized by the oil companies in the 1973 oil embargo to ensure that nobody went without oil. The producing countries were largely unaware of the oil's destination after it left their ports, and importing countries found the oil companies keeping up with delivery commitments to a remarkable degree—but not completely. The pressure on the oil companies from importing governments became so intense that the companies (historically opposed to any government intervention) voluntarily cooperated with the establishment of the International Energy Agency (IEA). The importing countries, of which there are far more than there were 50 years ago, were determined to end the secrecy of private transactions in the oil industry. If emergency allocation arrangements had not been made governmental through the International Energy Agency in 1974, there would have been an even greater proliferation of government-owned oil corporations. In the next embargo, the oil companies will not control the allocation of petroleum; oil will be dispatched on the basis of quotas determined by the IEA computer in Paris.

The second development to alter the power of the oil companies since 1973 has been the slackening of consumer demand while production capacity has continued to grow. It had been foreseen that a period of

production overcapacity would occur in the late 1970's as development of oil in Alaska, the North Sea, and Mexico would come on stream. At the same time, the United States and other IEA nations quietly implemented conservation policies—in some cases by raising prices and in others by spontaneous consumer action (i.e., Americans have been buying smaller automobiles). Thus, the problem is no longer simply overproduction; there are larger crises in the oil transport and oil refining industries. The world tanker market is at historically low rates, with many Norwegian and Greek ship-owners facing bankruptcy in the coming year.⁵ The glut of refineries and petrochemical complexes is forcing prices and profits down in a number of important sectors. Established petrochemical companies believe that they must modernize and maintain their market positions, while many developing countries (particularly the Arab OPEC members) have the money and the desire to build their own facilities. Texaco's capital expenditures for 1978, for instance, are scheduled to be about \$1.75 billion—at a time when there is a glut of capacity at every level of the industry. The short-term policy challenge for the next five years includes only gluts.⁶

DIVESTITURE

The appearance of overcapacity in the oil industry has also weakened the trust-busters' effort to break up the major oil companies in a movement known as "divestiture." Divestiture would end vertical integration in the industry by forcing oil companies to "divest" themselves of production or marketing.⁷ The support behind the divestiture movement varies, but includes those who consider energy a necessity of life and thus too important to be left to private decisions; those who want the government to regulate the prices of petroleum products for long-range purposes and to control the expenditure of funds on energy research and development; those steeped in the peculiarly American opposition to big business who regard the oil companies as major examples of overgrown businesses; and those who want to beat down the level of oil industry profits because of a sense of concern about the financial power given to the oil companies by their profit levels.

Today, the position of the oil industry has not strengthened the divestiture movement. In the last several years, small companies have been able to outmaneuver many of the majors in the scramble for crude sources and markets. Major oil companies have lost much of their political leverage in the wake of public discontent with their traditional role in politics. The movement of oil companies into new sources of energy

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⁵"The Shipping Slump," *The Economist* (London), March 4, 1978, pp. 73-74.

⁶See Frank R. Wyant, *The United States, OPEC, and Multinational Oil* (Lexington, Mass.: D.C. Heath, 1977), particularly chapter 3.

⁷The case has been made most articulately by John M. Blair, *The Control of Oil* (New York: Pantheon, 1976).

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"In the long run, certainly within the next 100 years, the use of non-fossil fuels must be developed in the United States or the future growth of the country will be in jeopardy [In the meantime] coal is a transition fuel, enabling the economy safely and relatively cheaply to buy time to develop cleaner, non-fossil energy sources."

The American Coal Industry

BY RICHARD NEWCOMB

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FOR the last 50 years, the coal industry in the United States has been declining, in marked contrast to the growth of the economy and rival fuels. This decline was brought about largely by the continuing fall in the price of oil and gas in an era of cheap energy, which ended in 1974 with the imposition of tariffs on oil by the Organization of Petroleum Exporting Countries (OPEC). The tariffs reflected OPEC's estimate of the differential between the cost of its remaining reserves of incredibly cheap oil and gas and the marginal cost of developing new fields elsewhere or of making synthetic fuels.

Even after this dramatic rise in the cost of coal's substitutes, most experts did not foresee a change in the role of coal, because of their expectation that most of our future energy needs could be met with inexpensive nuclear power. The prospects for coal's revival have improved only very recently, because of increasing anxiety over nuclear expansion using present reactors and because of rising doubt that a viable, cheap breeder technology can be developed soon. Even so, coal's prospects are clouded by environmental problems. Neither the population of coal-producing regions nor the small community of engineers and analysts conversant with coal technologies and petrographic characteristics are sanguine about massive increases in coal utilization, but almost all now admit the necessity of

substantial reliance on coal for the next 50 years.¹

Experts have stopped treating the demands for coal as a residual, abandoning the assumption that nuclear and other fossil fuels will be economically and environmentally preferred. As a result, new assessments are being made of the impacts of sizable coal expansion on the utility industry, on regional economies, and on the national economy. Recent micro-economic studies focus on the problems of labor health and productivity, on capital formation in the industry, on the technical solution to problems of coal conversion and on environmental control.

UNITED STATES COAL RESOURCES

The extent of the United States coal resource endowment is very large; using conventional measures, it is estimated that there are 3,600 billion tons of bituminous coals in the United States.² This estimate makes certain assumptions about the limits to which mining depths go and about rates of recovery. If coals are excluded from seams below 28 inches in thickness and 1,000 feet in depth, a quarter of the resource endowment consists of measured and indicated reserves. Perhaps half of this is recoverable. Some 360 billion tons are proved to some extent. An additional 740 tons can be inferred. Thus, within the range of current prices paid for fuels from \$.50 to \$5.00 per million British thermal units (MBtu), there are enormous tonnages of domestic coals.

Coals are not homogeneous commodities, but rather heterogeneous rocks, whose petrology differs considerably both within seams and among the principal provinces of the country, including the Appalachian, Interior, and Western Provinces in the lower 48 states (and principally in 12 states) plus Alaska. If sub-bituminous coals, lignites and shale resources of lower rank are also counted, the tonnages available are greatly increased. Residual tonnages of anthracites also remain after a century of depletion. Obviously much of the anthracite, lignite and oil shale can be mined within the \$.50 to \$5.00 per MBtu ranges, i.e., at a cost of \$12.50 to \$125 per ton.

The anthracites mined in the eighteenth and nineteenth centuries came largely from eastern Pennsylv-

¹Coverage of the industry's potential role outside the popular press has remained poor compared to the flood of expert investigation into oil, gas and synthetics. An overview of coal's problems and promise can be obtained most easily from reading *Coal as an Energy Resource: Conflicts and Consensus* (Washington, D.C.: National Academy of Sciences, 1977), which reports on economic, environmental and technical considerations related to increased coal output. For a review of recent analyses see also the excellent summaries by Richard Gordon. His *Economic Analysis of Coal Supply: An Assessment of Existing Studies*, obtainable from the Electric Power Research Institute (EPRI), reports on project 335, EPRI, Palo Alto, Ca.

²Those interested in the delineation of reserves more precisely can refer to the coal chapter in *U.S. Mineral Resources*, Professional Paper 820, 1973, by D. A. Brobst and W. P. Pratt of the U.S. Geological Survey.

nia. But most of the coal mined in the United States in the twentieth century has come from 50 major seams in five states: Pennsylvania, West Virginia, Kentucky and Ohio (the Appalachian basins) and Kentucky and Illinois (Eastern Interior basins). West Virginia, Kentucky, Virginia and Alabama contain the important seams of metallurgical coals. Little western mining of any note occurred until recently. However, about half the remaining United States coal reserves are west of the Mississippi. Almost all the tonnages mined since 1870 have been extracted at a cost of less than \$.15/MBtu in constant 1975 dollars. Most of this coal has come from underground mines.

Considerable tonnages in the western states, especially in Montana, North Dakota, Wyoming, New Mexico and Arizona can be mined for that price from the surface through the year 2050. The future of surface mining elsewhere in the United States is limited. All underground reserves and most eastern surface reserves cost five to ten times more to mine than western surface coals. In fact, western coals would have dominated United States production long ago, were it not for the fact that economies of location offset the technical advantages of surface mining from deep, relatively flat seams. The areal stripping of coal with draglines or huge shovels differs greatly from the contour stripping of thin seams familiar in Appalachia. In either case, however, reclamation costs are not trivial, and the failure to solve the problems associated with extensive surface mining satisfactorily has slowed its course.

Mountaintop removal, the other type of mining that may become common in the east, is not inexpensive. Augur mining, while cheap, is too wasteful of reserves to be practiced, given a high value of coal. Therefore, as the coal industry is expanded, there is no way to avoid a significant increase in eastern underground mine production.

The health and safety of miners have been a continuous concern, with serious implications for the costs of underground mining. The industry has one of the highest accident rates within the high-risk category of construction to which it belongs. Concern over accidents has prompted the passage of ever stricter coal mine health and safety laws; the most recent revision was made in 1969. The implementation of this law has changed working practices and contributed to a more than 30 percent decline in output per man. Health and pension payments, including federal compensation for black lung disability among retired miners, are a major cost of current output.

The analysis of coal costs and future industry supply patterns has been further complicated by recent environmental concerns relating to raw coal characteristics. The principal concerns to date have been over "major" accessory elements in coals—measurable in terms of percent weight—that are thought to contribute to ill health. Limits have been set on permissible levels

of sulfur, ash, and other pollutants in the emissions from coal combustion. "Minor" and "trace" accessory elements, measurable in terms of parts per million (ppm) and parts per billion (ppb), have also come under scrutiny recently in the stack gasses and residual wastes from coal production and use. Problems may arise from concentrations of cadmium, nickel, lead, selenium, arsenic and other trace elements in the disposal of coal wastes. Desulfurization and related costs can greatly increase the price of coal utilization.

The geology of coal seams also affects costs. Characteristics of individual seams, like seam thickness, partings, roof and floor stability or the presence of water, methane and other hazards, create variations in the rates of recovery and progress at the mining face, i.e., productivity. The removal of rock and other incombustibles by mineral preparation raises the nominal cost of coal by reducing the mass and thermal yield of clean coal from raw coal production. The highest levels of mineral preparation, common only for metallurgical coals, may add 50 percent to the shipping price. Thus, the range in price from the lowest to the highest covers a wide variation in practice.

At the bottom of the scale is the sale of uncleaned surface-mined coal to a mouth-of-mine utility with virtually no environmental controls on its production or use. At the top of the scale is the shipment over a considerable distance of a highly prepared, underground metallurgical coal to a steel mill under strict environmental surveillance throughout the mining and utilization cycle. The range of median coal prices effective for this wide range in practice and use is from \$5.00 to \$50.00 per ton. The range of extreme values is from \$2.50 to \$125.00 per ton delivered. This is the range, more or less, that applies to proved and indicated reserves mined in the future. The economics of the industry are defined by the forecast of supply patterns and levels of demand that will obtain for coals from various regions, given these prices and the costs of rival fuels. How viable is the industry given its matrix of costs and environmental constraints? To answer this question it is useful to look briefly at its past.

THE HISTORY OF THE COAL INDUSTRY

The coal industry today is largely the residual of two historic periods of investment. The first, from the Civil War through the 1920's, financed the rise of the bituminous coal sector in the central Appalachian states and Illinois. During this period, soft coal replaced anthracite as the dominant fuel. By 1929, bituminous coal supplied well over half the United States energy needs, with a capacity of 600 million tons. (To aid comparisons, it is convenient roughly to estimate industry investment and capacity in terms of current (1970-75) price levels and output, when production years of 600 million tons have again occurred.) In 1870, the annual production of the industry was 35 million tons, with \$700 million of in-

vested capital; in 1909, production was 380 million tons, with \$3 billion invested, a phenomenal expansion.

The industry doubled in size and capital in the next ten years. By 1920, the soft coal sector employed over half a million miners, had \$6 billion in capital, and produced 570 million tons. Value added was over \$6 billion. These levels of output continued high throughout the 1920's, but values fell, signaling the conditions that have characterized the industry ever since: chronic excess capacity. In 1926, a record year for the United States economy, the value of coal output had fallen to \$3 billion on an equally high production level of 570 million tons.

Many large mines that came on stream during the mid-1920's in response to high profits were cutting prices drastically to maintain output. This created terrible hardship in Pennsylvania, West Virginia and elsewhere, with enormous pressures on wages, which fell by 50 percent at a time when prices and incomes elsewhere in the country were rapidly rising. By 1929, the peak year of expansion, the troubled industry had a capacity well over 700 million annual tons, 30 percent of it chronically idle.

The Depression, of course, drove conditions in the coal fields from bad to intolerable. The first act of the administration of President Herbert Hoover after the stock market crash of 1929 was to secure the passage of relief bills for the mining counties of Appalachia, to prevent starvation. Coal output subsequently fell to 310 million tons and was accompanied by a general liquidation of capital.

The industry recovered to meet the needs of World War II. It was stabilized by the United Mine Workers union under John L. Lewis and was re-equipped by wartime bank financing. But structurally it had changed very little. The character of inter-fuel rivalry and competition, however, had changed dramatically over the intervening years, masked only by the Depression and by wartime constraints on consumption. In 1918, the demands for coal were well diversified, spread almost equally among metallurgical, industrial, commercial, and transportation markets. While anthracite was the dominant residential heating fuel, soft coals of higher quality also commanded excellent prices and shares in this market. Electricity was a small though important demand.

In 1948, with output and utilization levels almost the same as in 1918, the industry again received \$6 billion for 600 million tons. Its 500,000 miners were fully employed. But the structure of demand had shifted greatly and in unperceived ways. The dieselization of the railroads and the growth of the auto and truck industries, along with the expansion of cheaper, superior fuels for residential and industrial uses, had reduced coal markets to a single traditional sector: steel. Only electrical utility demands grew. Total output fell over 50 percent despite electricity growth through 1960,

and coal's share in United States energy fell to minor proportions.

Thus, a singular contraction of the industry had taken place, propelled by an era of cheap energy and superior fuel technologies. From World War II through 1969, capital left the industry. Facilities depreciated and coal reserve values fell effectively to zero. The second period of investment, therefore, has been almost entirely associated with the growth of electric utility requirements for large production tied to major new power generating stations, often mouth of mine. Because this process took place during industrywide net disinvestment and chronic excess supply, this was a profitless expansion, leaving no surplus or earning power in the industry and offering little basis for financing, other than equipment loans. Like the railroads, the coal industry has been informally bankrupt for years, with its facilities chattel to its major users, whose long-term contracts to buy were the only way to satisfy the lenders.

Finally, the investment was locational in character, favoring a switch to large surface mines and away from the underground sector or away from the smaller producers to larger underground mines capable of the economies of unit train shipment. By 1965, when the semblance of industry growth was restored by the continued increase in electric power demands, the number of mines had been drastically reduced, its book values almost erased, and two thirds of its labor force eliminated.

THE COAL INDUSTRY 1970-2050

The industry's current problems, like its structures, are directly related to its past circumstances. In the 1970's, a new period of accelerated investment began. However, the pressures on the industry's factors have been only recently removed, despite the rise in the marginal cost of rival fuels. Pressures on labor have continued, because most coal is sold on long-term contract, and coal prices did not rise on average for some time after initial rises in the cost of rival fuels. In addition, effective government regulations on domestic oil and gas prices have kept the average cost of these fuels to users depressed significantly below their marginal cost. The substitution of coal is signaled, therefore, only when the user industries expand. Without rate reform, it is doubtful that utilities can expand. Until recently, pressure on capital investment also remained because utilities did not abandon their hopes for the rapid growth of very cheap nuclear power until the administration of President Jimmy Carter slackened its drive to forcefeed the commercialization of nuclear power through research and other subsidies. After reexamining the costs of nuclear power, most utilities have switched their fuel choices for new facilities to coal. Clearly, oil and gas at the current imported price of \$2.25 per MBtu are too expensive to use in power generation, since coals can be cleaned and scrubbed to meet standards for \$1.00 to \$1.25 per MBtu.

For the near future, the industry is the most obvious choice in boiler fuel markets. This switch will be accelerated by the deregulation of rival fuels. In the meantime, coal's image and practices have been fashioned of necessity from the pressures of stagnation and excess capacity. The industry's most serious problem can be measured by the large number of dependent miners with damaged health, by the inadequate pensions it gives retirees, and by the high accident rates afflicting active miners. If accidents serious enough to disable or to report are added to fatalities, almost eight to ten percent of the labor force are likely to be injured each year in underground mines. Surface mining accident rates, while lower, are also alarmingly high.

It has proved philosophically difficult for the industry or its regulators to examine the relationship between the economics of production, mine accident rates, and the productivity of labor. However, because productivity has declined so markedly with the enforcement of health and safety laws, that relationship cannot go unexamined much longer. Because it relies on tonnage royalties to support its welfare benefits, the union has been a victim of its own fall in productivity. This paradox greatly complicated negotiations between the operators and the union in the 1978 contract bargaining.

The next largest casualty has been the environment of the producing regions. The shift to contour stripping brought serious problems along with lower coal prices; namely, acid mine drainage, slope instability, flooding, and the failure to revegetate or reclaim sites. In the regions where utility expansion was based on large areal surface mines, cheap electric power has meant wastelands from mining. Underground, mine subsidence, water pollution and the costs of sealing abandoned mines have added to the high social cost of mining. These costs were unrecovered by states throughout the era of cheap energy prices.

The health hazards in consuming regions have not been so easy to identify. Clearly, there is an association between levels of sulfur oxide emissions and pulmonary problems in conjunction with small particle emissions. Particles smaller than several microns, but larger than one micron, in combination with sulfur, constitute a health hazard. Other problems, such as those associated with certain toxic trace element concentrations, remain a worry. In the past, the industry has been hard pressed to remedy these problems because of the severe price competition between coal and cleaner fuels.

However, with the rise in price of cleaner fuels, coal prices in the future can rise enough to compensate for the increased costs of compliance with environmental and safety regulations. There are few places in the United States which cannot be served with coal if mineral preparation "best practice" is applied or if scrubbers are adopted. The principal objections to coal, therefore, focus on the differential impacts of regulations falling on coals of one region or another and the conflicting

desires of groups within producing states or consuming regions to reduce or to increase their level of coal use.

The mechanism for both the improvement of mining conditions and growth of the industry lies in the traditional working of the marketplace. In most regions, with environmental controls strictly enforced, coal supply is unlikely to exceed demand for many years. Industry profits appear sufficient to insure the generation of capital for expansion. At the same time, higher profits will supply the means of compliance with environmental and safety regulations. As coal prices rise, the value of coal reserves is being restored and appears in the book values of firms going to capital markets. This increase in total capital/output ratios, along with the increase in income, gives firms access to credit far beyond the confines of those equipment loans to which they were restricted in the period of decline. Probably open market competition alone will supply the demands for investment in utility coal over the next 50 years. The metallurgical markets have always secured prices sufficient to insure the stability of mine investment in their sector. The future of the industry, therefore, is in question only in the markets for industrial and commercial fuels, either directly or in the form of synthetic oil or gas.

For the next 25 years, assuming price deregulation, domestic reserves of natural oil and gas are sufficient to insure continued production of these fuels at present levels. Subsequent to deregulation, higher prices will force their conservation. Some growth is also bound to occur in conventional nuclear power. In any event, it is difficult to imagine any realistic growth of electricity's share in total energy that could not be met by clean coal utilization and conventional power generation. Almost any realistic growth in total energy demand can be met without significant increases in either imported or nuclear fuel through the turn of the century. By then, coal consumption in direct use would be approaching 2 billion tons annually. Gross capital investment would cumulate to \$50 billion, and the capital output ratio in the year 2000 would double. Most of this coal would be provided at prices under \$2.00 per MBtu or \$50 per ton, well below the projected price of domestic oil or gas in constant dollars or the current price of imported oil.

Modest amounts of synfuels from coal would be required to meet these turn-of-the-century projections without imports. However, their cost would be considerably higher than the current price of imported oil, if the technological requirements of coal conversion lie within the range predicted by cost engineering esti-

(Continued on page 228)

Richard Newcomb is widely published in the area of mineral industries, depletion, and the effects of technological change on these industries. His current research interests have centered on the development of domestic coal resources.

"Electric utilities now consume nearly one-third of the nation's annual consumption of primary energy sources; they are the only commercial consumer of nuclear energy and provide service to virtually all households and businesses in the country."

Energy and the Electric Utilities

BY MARTIN L. BAUGHMAN

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IN the United States, electricity is the keystone for essential services like heating and air conditioning, refrigeration and communications and is also a basic input for essential industrial processes like the manufacture of aluminum. Electric utilities now consume nearly one-third of the nation's annual consumption of primary energy sources; they are the only commercial consumer of nuclear energy and provide service to virtually all households and businesses in the country.

Historically, the industry has been one of the most consistent high growth industries of the United States economy. Sales of electricity grew at an annual rate of about 7 percent per year for 30 years prior to the recession in 1974.¹ The industry is unique among energy industries in that it is a highly regulated natural monopoly. The practice of licensing utilities started in the early 1920's, and regulation of electricity prices dates back to the Federal Power Act of 1935.

Pricing practices grow out of the characteristic cost of electricity supply. The supply of electricity can be divided into three basic activities—generation, transmission and distribution.² The generation of electricity is accomplished by the conversion of chemical, nuclear or other energy forms into electrical energy. Transmission is the process of transporting electrical energy over a conducting medium—a transmission line. The economics of electrical energy transport make the use of high voltage transmission lines attractive. Distribution of electrical energy includes the process of converting the high voltage power from the transmission system into lesser voltages appropriate for use in households, commercial industry, and other business establishments and delivering the product.

The industry has long been a major consumer of coal in this country, and in the last 15 years nuclear power has grown from a negligible to a significant source of electrical output. Because of the nation's anxiety about its dependence on scarce oil and natural gas supplies, and because of the industry's ability technically to substitute coal and nuclear power for oil and gas in the long run, the industry may help stimulate progress toward energy independence. However, nuclear and coal generation are not without their problems; the long-term outlook for both is seriously clouded by existing energy policy, and economic and environmental uncertainties.

THE ORGANIZATION OF THE INDUSTRY

The electric utility industry is comprised of a large number of companies varying in size and ownership that are engaged in one or more of the three activities listed above. These companies act as agents, who utilize money supplied by the owner or owners of the firm to purchase production plant, to pay labor and to buy the materials and fuel to manufacture a product—electricity—and sell it to other companies in the industry or to the consuming public. The three basic types of ownership in the industry are private, public and cooperative. The privately owned sector of the industry is by far the largest and consists of companies owned and operated by individuals or corporations.³ Stocks in many of these companies are widely traded on the major stock exchanges. The publicly owned sector of the industry consists of those utilities owned and operated by government organizations like municipalities, federal agencies or state or other public power projects. The cooperatives are government-financed and owned by the customers.

The outstanding economic characteristic of public utilities including electric utilities is that they operate at their greatest efficiency as monopolies, because electricity can be provided at lower cost when the duplication of facilities by competitive firms is avoided. Unlike other stock corporations, public utilities operate as monopolies with government approval and supply an indispensable service. Government regulation is a substitute for competition in the market for the public utility services. The electric utility companies in the

¹See, for example, the historical statistics on sales in the *Statistical Yearbook of the Electric Utility Industry for 1976* (New York: Edison Electric Institute, 1977).

²For further discussion, see Federal Power Commission, *1970 National Power Survey* (Washington, D.C.: U.S. Government Printing Office, 1970).

³The privately owned sector of the industry possesses about 78 percent of the nation's generating capability, the publicly owned sector has about 20 percent, and the remaining 2 percent is possessed by cooperatives. *Statistical Yearbook of the Electric Utility Industry for 1976*, *op. cit.*

United States, whether publicly or privately owned, are considered public service corporations and will hereafter be referred to as public utilities.

The rights and duties of a public utility are spelled out in law and in court decisions. A public utility has the right to charge a "reasonable rate" for its services, is entitled to a grant, by public authority, of a franchise in some form that provides it with an exclusive right to serve a specific service area free of competition, and enjoys the right of eminent domain. Accompanying these rights is a substantial array of duties that public utilities are obliged to assume, including the obligation to meet all reasonable demands for service by those who can pay, to provide service reliably, with quality adequate to the needs of its customers, and to establish reasonable rates without unjust discrimination. In addition, utilities may not change or expand their service area without the prior finding by a regulatory agency that the move would be in the public interest and must secure approval from public authority before terminating service or abandoning a market.

The principal government authorities engaged in the review and adjudication of the interests of the consuming public and the utility are the state utilities commissions and, in interstate affairs, the Federal Energy Regulatory Commission of the Department of Energy.⁴ These regulatory agencies wield enormous power over the affairs of the nation's electric companies, most significantly, the power to review rates. Perhaps their most difficult task is their obligation to strike a balance between the utility's right to a "reasonable rate" and the consumer's right to a rate developed without "unjust discrimination."

THE PRICING OF ELECTRICITY

The analysis of costs as an aid to the design of rates has long been the subject of study in the electric utility industry. The intense public reaction to the increases in rates as a result of the 1973-1974 fuel price increases renewed interest in the subject of the costs of electricity production and the design of rate schedules. Many critics advocate the reform of rates to reflect the costs of service more clearly. However, the cost of service is not always easy to determine.

An electric utility company must be prepared to meet the reasonable demands of the consuming public. The most prominent characteristic of the demand for electricity is its wide periodic fluctuation, which follows daily, weekly and seasonal patterns. These regular fluctuations in demand are important because electricity

cannot readily be stored. The total amount of production plant required is thus dictated by the peak demand, and to meet peak demand reliably, electric utilities must provide reserve plant capacity to assure the continuity of service in the event of a breakdown or some other outage. The amount of total utility plant and equipment required is therefore dictated by the maximum demand anticipated throughout the year. The consequence is that a portion of the utility's plant capacity will be idle for a large part of the year, and the entire plant will be utilized for only a relatively short period of time during the year. This burdens the utility with high fixed costs, i.e., the requirement to pay a return on capital used to make available production plant regardless of utilization of that plant. This means that electric utilities must employ more capital per unit output on the average than any other manufacturing industry.⁵

The development of rate schedules for electricity has historically been separated into two interrelated steps. The first and more standardized step is the determination of a total revenue to be allowed to the business unit, in this case the utility company, to afford it an opportunity to cover all proper operating expenses, taxes and depreciation expense; in addition, its revenue must provide a return on the net valuation of its property adequate to provide debt interest, dividends on its capital stock, and contribution to earned surplus. The second step of pricing is the allocation of the total revenue to be collected to the product sold. Historically, an attempt has been made to base the price of the product sold to each customer on the cost of providing service to that customer. Conceptually, this seems clear enough, but in practice there are different reasonable ways of allocating the costs of providing service and different ways of factoring the resultant costs into the rate schedules.

The type of regulation used to set total revenues allowed the utility company is generally known as rate-of-return or rate-base regulation. In this procedure, regulatory commissions attempt to set prices that will yield a predetermined fair rate of return on the rate base after making allowances for operating and maintenance costs, depreciation, and taxes.

The rate base is composed principally of the net valuation of the electric utility's tangible property, comprising plant and equipment used and useful for serving the public. The rate base also includes an allowance for working capital, which is determined in rate cases in a variety of ways. The rate of return allowed on the rate base of the utility company is determined from the cost of capital. A weighted average cost of capital is used which takes into consideration the interest obligations on the company's debt and a "fair and reasonable" rate return on the company's capital stock. Operating and maintenance costs include the cost of fuel, the cost of repairs and maintenance, and salaries and wages to employees.

⁴Prior to the creation of the Department of Energy in 1977, the Federal Power Commission had responsibility for regulation of interstate sales of electrical energy.

⁵Electric utilities employ over \$4 capital per dollar annual sales. This is more than 5 times the average of all manufacturing industries and about 50 percent higher than the telephone industry. See Edison Electric Institute, *Economic Growth in the Future* (New York: McGraw-Hill, 1976), p. 289.

**Table 1: Distribution of Electric Revenue Dollar
(in Percent)**

| | 1977 | 1975 | 1970 | 1965 |
|--------------------------|------|------|------|------|
| Fuel | 36.8 | 34.6 | 19.8 | 15.4 |
| Maintenance | 6.3 | 6.0 | 7.3 | 7.0 |
| Other Operating Expenses | 13.8 | 15.1 | 19.1 | 19.5 |
| Depreciation | 8.5 | 9.1 | 11.7 | 11.8 |
| Taxes | 15.4 | 14.8 | 18.3 | 22.5 |
| Net Income | 19.2 | 20.4 | 23.8 | 23.8 |

Source: "1978 Annual Statistical Report," *Electrical World* (Hightstown, New Jersey: McGraw-Hill, March 15, 1978), p. 101.

Table 1 presents the national average distribution of the electric revenue dollar for 1977 and selected previous years. The first three items in the table represent out-of-pocket operation, maintenance, and fuel expenses. The increase in the portion of total electricity cost attributable to fuel since 1974 is readily apparent. Tax expenses include income and property taxes. Depreciation and net income represent return to capital stock.

Everything in the total revenue calculation is fairly straightforward except for the item "fair and reasonable" rate of return on the company's capital stock. The determination of a fair rate of return translates directly into the question as to what is a fair profit, and on this topic there may be substantial disagreement between the stockholders and the customers of a utility. In this area the utilities commission wields its influence. After hearing the advocates and the opponents of fair and reasonable rate changes, a ruling is made. If the rate of profit is too low, the utility will find it difficult to secure financing for new production plant, thus placing in jeopardy the utility's ability to assure that reasonable future demands for service can be met efficiently and reliably.⁶ On the other hand, if the rate is set too high, customers pay more than necessary, and some incentive for the utility to behave efficiently is lost.

Within the overall revenue constraint placed upon the firm, the electricity must be priced to different customers. To form rate schedules for alternative customers, the utility's total costs have historically been classified in three categories: customer costs, energy costs and demand or capacity costs. Customer costs are those costs that vary with the number and type of customers, like meters, billing costs, costs of meter reading, line transformers. Energy costs are those costs

that vary most closely with the level of kilowatt hour generation and delivery, the best example being the cost of fuel. Demand or capacity costs are those associated with making available, or more precisely having made available, a supply, transmission and distribution capability. The investment costs of generation, transmission and distribution facilities provide the best examples in this category.

On the basis of similarities in costs, customer classes are defined. At a minimum, there are usually at least three customer classes—residential, commercial (sometimes called small light and power), and industrial (sometimes called large light and power). Within these main classes, there may be further subdivisions, like all-electric residential customers and residential customers with electric water heating but no electric space heating. These finer distinctions among classes need not concern us here, but it must be remembered that sometimes different schedules of rates may apply.

When allocating costs to determine fair rates for alternative customer classes, the allocation of energy and customer charges to kilowatt hours sold is usually a fairly straightforward procedure. However, the allocation of the capacity charges is much harder to account for because of the joint nature of the capacity costs; i.e., facilities are used simultaneously to serve more than one class of customer. What portion of the capacity charges are to be allocated to whom is generally the point of contention among those who differ on rates. In the past, utilities commissions generally allowed utility management considerable latitude in the allocation of the capacity costs and the design of rate schedules within the limitation that total revenues were not to exceed the approved total cost of service.

Within the total revenue constraint and the guidelines of reasonableness, arguments can be made for various objectives within the structure of rates.⁷ There might be alternative objectives: (1) to maximize the utilization of supply equipment, (2) to assure maximum stability of revenues, (3) to promote and retain the maximum economic development of the market area, (4) to discourage growth in consumption and maximize conservation of energy or (5) to minimize economic hardship on the poor and economically disadvantaged. The nature of the rates paid and the rate schedules that result can vary widely depending on the weightings of the above objectives. Historically, rates have taken a form that tends to promote growth and assure stable revenues.

The declining block rate schedule is most widely used for residential and other small-volume users. This type of schedule offers a decreasing price per unit of electrical energy for successive blocks (quantities) of consumption. An example of such a rate schedule for a monthly billing company is given in Table 2.⁸

The customer's bill is figured by cumulating the charges incurred for each successive block of energy

⁶Further discussion of the implications appears in M.L. Baughman, and P.L. Joskow, "The Future Outlook for U.S. Electricity Supply and Demand," *Proceedings of the IEEE*, vol. 65, no. 4 (April, 1977), pp. 549-561.

⁷See Electric Utility Rate Design Study, *Rate Design and Load Control, Issues and Direction, A Report to the National Association of Regulatory Utility Commissioners* (Palo Alto: September, 1977).

⁸After P.J. Garfield and W.F. Lovejoy, *Public Utility Economics* (Englewood Cliffs, New Jersey: Prentice Hall, 1964), p. 155.

taken or fraction thereof. The declining block rate schedule as well as other schedules may also include other charges, like a "service charge" or a "fuel adjustment charge." A service charge is simply a fixed amount per month regardless of consumption. A fuel adjustment charge is a pass through (or return) to the customer of the amount that fuel costs per unit output exceed (or are exceeded by) a base value already factored into the declining block rates. The use of the fuel adjustment charge became virtually universal in the period of volatile fuel prices after the oil embargo in 1973.

Inherent in the declining block rate schedule are volume discounts—the more used, the less the average cost per unit. This is consistent with the fact that given the same fixed annual costs, the more sales the utility can promote the lower will be the average fixed costs per unit output. Thus declining block rate schedules bear significant resemblance to how total average costs behave for the entire firm; thus there is some basis in fact in claiming that declining block rate schedules are cost-based. We shall return to a major shortcoming of these rates in a moment.

For large-volume customers, the current practice is generally to charge according to a two-part rate schedule, also called a Hopkinson rate schedule.⁹ The Hopkinson rate schedule provides separate charges for maximum demand and energy consumption. The customer's bill is then the sum of a demand charge and an energy charge. An example is given in Table 3.¹⁰ To implement this type of rate schedule requires a measurement or an estimate of peak demand. Typical residential meters do not possess this capability; a more sophisticated and expensive meter is required. The additional expense can be justified only in the case of high volume users.

A major practical shortcoming of both types of rate schedules now prevalent is that neither differentiates rates according to the time of use. It is the peak demand that determines capacity needs, and the costs of carrying capacity comprise a large portion of the total cost of service. Since the rates now commonly used do not differentiate according to whether the use is during peak or off-peak periods, there is no incentive for customers to reduce consumption during peaks, which in turn would reduce the need for new capacity. This problem is being corrected.¹¹ Time-dependent rates are being tried on a trial basis in many utilities. Over the next few years, the incorporation of peak responsibility into electric rates will probably become more and more prevalent in the form of seasonally and time-of-day differentiated rates. The trends in average price per kilowatt hour will depend upon the costs of future supply.

⁹Devised by John Hopkinson in 1892.

¹⁰Garfield and Lovejoy, *op. cit.*, pp. 156-157.

¹¹Electric Utility Rate Design Study, *Rate Experiments Involving Smaller Customers* (Palo Alto: Task Force no. 3, January 21, 1977).

Table 2: A Block-Rate Schedule

| | |
|----------------------------|------------------------|
| First 10 kilowatt hours | \$1.05 |
| Next 40 kilowatt hours | 4.5¢ per kilowatt hour |
| Next 50 kilowatt hours | 3.9¢ per kilowatt hour |
| Next 100 kilowatt hours | 3.3¢ per kilowatt hour |
| 201 kilowatt hours or more | 2.5¢ per kilowatt hour |
| Minimum charge | \$1.05 per month |

Table 3: A Two-Part Rate Schedule

| | |
|-------------------------------|-------------------------|
| Demand Charge | |
| First 2 kilowatts demand | \$2.25 per kilowatt |
| Next 18 kilowatts demand | \$2.00 per kilowatt |
| All over 30 kilowatts demand | \$1.25 per kilowatt |
| Energy Charge | |
| First 1,000 kilowatt hours | 2.50¢ per kilowatt hour |
| Next 4,000 kilowatt hours | 2.00¢ per kilowatt hour |
| Next 10,000 kilowatt hours | 1.50¢ per kilowatt hour |
| Next 95,000 kilowatt hours | 0.90¢ per kilowatt hour |
| All additional kilowatt hours | 0.70¢ per kilowatt hour |

TRENDS IN ELECTRICITY SUPPLY

Electricity is currently produced primarily from fossil fuels, with modest amounts derived from hydroelectric and nuclear sources. The total electrical energy generated in the United States in 1976 is tabulated by energy source in Table 4. The history of electricity production has been one of movement from one source to another.

In the early part of the century, hydroelectric energy provided the bulk of electrical output; hydroelectric energy gave way to coal in the second quarter of the century. By the mid-1950's, coal was being used to generate around 55 percent of the electricity produced. Around the mid- to late-1950's the use of natural gas to generate electricity began to grow, especially in the southwestern part of the country. Over the period 1955 to 1968, however, the consumption of other fossil fuels increased so much that all sources maintained a relatively constant share of total electricity generated. Early in this period, the process of fissioning uranium to release energy to generate electricity was also demonstrated commercially.

Table 4: 1976 Electrical Generation in the United States (by energy source)

| | Billions of kilowatt hours | Percent of Total |
|----------------|----------------------------|------------------|
| Hydroelectric* | 284 | 14 |
| Coal | 945 | 46 |
| Oil | 320 | 16 |
| Natural Gas | 295 | 14 |
| Nuclear | 191 | 10 |
| Total | 2035 | 100 |

*Includes a small amount of geothermal, wood and waste.

Source: "1978 Annual Statistical Report," *Electrical World* (Hightstown, New Jersey: McGraw-Hill, March 15, 1978), p. 90.

NUCLEAR POWER

By the late 1960's the environmental movement had appeared and concerns about air quality made coal appear to be an inferior electricity generation alternative. Many coal plants were converted to use cleaner burning oil and natural gas, and utilities began to look favorably on nuclear power. In late 1973, the promise of nuclear power was boosted by huge increases in the price of oil and shortages of natural gas. However, shortly thereafter, nuclear power began to lose some of its bloom.

Today there are many varieties of nuclear fission power plants, like the Canadian Heavy Water Reactor, the High Temperature Gas Reactor, and the British Advanced Gas Reactor, but the nuclear system used predominantly in the United States is the Light Water Reactor (LWR). In 1976, about 10 percent of United States electricity was generated by 58 nuclear plants; 56 of these were LWR nuclear plants.¹² In 1977, six new nuclear generating plants were brought into service, and nuclear accounted for 13 percent of the electricity generated in the United States.¹³

To supply an increasing percentage of the nation's energy needs, many planners in the Department of Energy, the electric utility industry, and the scientific/engineering community have counted on additional nuclear power plants. They believe that an increasing number of nuclear power plants are needed (along with coal plants) to reduce the amount of oil and gas used to

generate electricity and to meet future growth in consumption. These same planners at various times in the past five years have projected that the number of nuclear power plants operating by the year 2000 would range from 500 to 1,000.¹⁴

From 1972 through mid-1974, those projections appeared to be realistic. In 1972 and 1973, the electric utility industry contracted for over 60 additional nuclear power plants. The momentum of ordering spilled over into the first half of 1974, as the cumulative level of firm commitments to nuclear power approached 230 plants. However, by late 1974, the electric utility industry had moved into a period of severe difficulty. The industry experienced the first hiatus in demand growth in over a quarter of a century and was beset with serious cash flow problems, the combination of which resulted in the cancellation of several nuclear plants. Other plants were delayed so far into the future that the contract between utilities and their vendors constituted little more than an agreement to do business together if the occasion arose. Since then the situation has, if anything, become more uncertain. As a result, since early 1975 the total commitment to nuclear power plants by the electric utility industry has remained around the 200-plant level.¹⁵

The long-term prospects offer little hope of change. The nuclear industry has long operated under the assumption that the fissionable uranium and plutonium contained in the discharged reactor fuel would be separated from the fission products and recycled into fresh batches of nuclear fuel.¹⁶ Indeed, the breeder reactor—the nuclear technology that has long received the largest single share of the federal energy research and development budget—is impossible to commercialize without such a fuel recycle scheme. Its entire principle is to enhance the conditions under which plutonium is produced (i.e., plutonium is bred from uranium). Without the recycle of spent fuel and the recovery of plutonium the breeder is worthless. But current policy as set forth in President Jimmy Carter's energy plan states:¹⁷

It is the President's policy to defer any U.S. commitment to advanced nuclear technologies based on the use of plutonium while the United States seeks a better approach to the next generation of nuclear power than is provided by the plutonium breeder. The U.S. will defer indefinitely commercial processing and recycle of plutonium.

Without recycle of the spent fuel, we are limited to using

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¹²"1978 Nuclear Plant Survey," *Electrical World*, January 15, 1978, pp. 39-49. Actually these plants comprised a total capacity of about 43 million kilowatts. New nuclear plants being installed have capacities in the neighborhood of 1 million kilowatts. For the remainder of the paper the term nuclear plant is used to denote about 1 million kilowatts capacity.

¹³"1978 Annual Statistical Report," *Electrical World*, March 15, 1978, p. 90.

¹⁴See, for example, U.S. Atomic Energy Commission, "Nuclear Power 1972-2000," WASH-1139(74) (Washington, D.C.: U.S. Government Printing Office, 1974).

¹⁵"1978 Nuclear Plant Survey," *op. cit.*, pp. 39-49.

¹⁶Currently the nation's nuclear reactors use enriched uranium as fuel. Uranium occurs naturally in two atomic isotopes, U^{238} and U^{235} , the difference is in the number of neutrons contained in the nucleus. The U^{235} isotope is the fissionable isotope of uranium but it occurs in nature as only 0.32% of all uranium. The remaining 99.7% is the U^{238} isotope. Uranium-238 is not fissile, but in normal reactor operating conditions some of the U^{238} will be transformed into plutonium, a fissile element. The uranium is enriched so that about 3 percent of it is the U^{235} isotope. A chemical compound of this uranium is then fabricated into fuel rods and inserted into the reactor as fuel. After a period of time in the reactor the spent fuel is extracted. It still contains some U^{235} that has not fissioned (about 0.8 percent), it contains some plutonium produced from the U^{238} , and it contains radioactive fission products.

¹⁷Executive Office of the President, *The National Energy Plan* (Washington, D.C.: U.S. Government Printing Office, April 1977), p. 20.

"In the case of natural gas, continued regulation-induced shortages cannot be justified, since the cost of these shortages would far outweigh the gain that some consumers would receive by being able to pay lower prices."

The Natural Gas Industry

BY ROBERT S. PINDYCK

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NATURAL gas has become an increasingly important source of energy in the United States over the last 30 years.* Between 1945 and 1970, natural gas production and consumption increased by 450 percent, from 4 trillion cubic feet (Tcf) per year to 22 Tcf per year, and as a share of total energy consumption, natural gas rose from 12 percent to about 33 percent. Natural gas became the major fuel for home heating; for the United States as a whole, it now accounts for over 40 percent of residential energy consumption, and in some regions of the country the fraction is much greater. Because gas prices have been maintained at low levels, this fuel has increasingly become the choice of electric utilities and large industrial consumers. This, of course, is not surprising; gas has been clean, convenient and, most of all, cheap.

Between 1970 and the present, the demand for natural gas has continued to grow at an average annual rate of 5.3 percent. Production, however, ceased growing in 1970, and began declining in 1972. The result has been a growing shortage that began in 1971 when some industrial consumers found their non-interruptible ("firm") contracts being interrupted.¹ By 1973, it was no longer possible to have gas lines installed in new homes built in many regions of the country, and a larger

number of industrial consumers found their supplies curtailed. The Federal Power Commission and the Federal Energy Administration (FEA) predicted serious shortages for the winter of 1975-1976, and the Congress considered proposals for allocating natural gas in case these shortages occurred. That winter was mild, so the actual shortage was only about 2.5 Tcf (10 percent of total demand), but the following winter was severe, and large shortages materialized. By the FPC's own reckoning, curtailments nationwide were 23 percent of "firm" requirements, and the shortage was particularly severe in several states. Aside from the direct cost of unfulfilled demand, the shortage resulted in the additional unemployment of about one million people during the month of January, and over \$4 billion of lost GNP.

The direct cause of this shortage has been price regulation by the Federal Power Commission. By maintaining an artificially low price, the FPC made natural gas the choice fuel (for those consumers who could obtain it), so that demand grew rapidly. At the same time, low prices depressed supplies. This occurred for two reasons. First, the incentive was removed for the exploration and discovery of new natural gas reserves, and as a result total United States reserves of gas fell by about one-third between 1967 and 1976. This dwindling reserve base made it impossible for producers to satisfy the demand for new long-term contracts. Second, low prices removed the incentive to produce gas out of existing higher cost reserves, so that production fell even with respect to a particular level of reserves. This situation of rapid growth in demand combined with dwindling supplies can only grow worse if recent policies of price regulation are continued.

How did we manage to institute this system of price controls, given that it has resulted in shortages? The FPC was originally authorized by the Natural Gas Act of 1938 to regulate the transport charges of the interstate pipeline companies (which do have considerable monopoly power in several regional consumption markets). But the scope of the act was unclear, and as prices paid by gas consumers began increasing, pressure was brought on the FPC to extend controls to wellhead prices. The FPC refused to extend its jurisdiction until 1954, when the Supreme Court,² in the Phillips deci-

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¹In fact, the FPC found production to be 3.7 percent below demand in 1971. Among those consumers who were curtailed were farmers who used natural gas to dry their newly harvested grain. The result of the curtailment was that grain could not be dried quickly enough, and it rotted.

²This case against the Phillips Petroleum Company, brought by the Attorney General of Wisconsin, was based on the argument that although the pipelines were regulated, wellhead price increases by large petroleum companies could be passed through as "costs" in pipeline wholesale prices, thereby increasing retail prices to the consumers. The Supreme Court, although not claiming that gas producers had monopoly power, did find that the FPC should regulate wellhead prices. For further discussion, see Paul MacAvoy and Robert Pindyck, *The Economics of the Natural Gas Shortage (1960-1980)* (Amsterdam: North Holland Publishing Co., 1975), pp. 12-14.

sion, ordered it to regulate the prices of gas sold to the interstate pipelines.

The FPC first attempted to regulate wellhead prices following the practices of state public utility commissions, i.e., by choosing an allowed rate of return on capital, and then determining the price that would equate revenues with the sum of operating costs, depreciation, and the allowed rate of return applied to undepreciated capital. However, this approach resulted in wellhead prices nearly doubling between 1954 and 1959, and the FPC became bogged down in a backlog of cases. As a result, the FPC turned to areawide price ceilings that were based on regional average accounting costs. The result was that wellhead prices were essentially frozen after 1960, since these price ceilings forced producers to limit exploratory effort to low cost drilling projects—which in turn maintained low price ceilings. The average new contract price was 18.2 cents per thousand cubic feet (mcf) in 1961, and only rose to 19.8 cents per mcf in 1969; and the average wholesale price paid by utilities only rose from 32 cents per mcf to about 33.2 cents. On the other hand, wholesale oil and coal prices increased 15 percent and 22 percent respectively during this period.

After shortages began occurring in 1971, the FPC ended its price freeze, and in a series of rate decisions allowed new contract prices to rise.³ By 1972, average new contract prices had increased to 33.6 cents per mcf, although with considerable regional variation. In July, 1975, the FPC announced a uniform “national area rate” of 42 cents per mcf; this rate was raised by the FPC to 51 cents in November, 1975, and cost-justified price increases were to be allowed in future years. In fact, new contract prices averaged about 55 cents in 1974 and 60 cents in 1975, because of allowances by the FPC. While these prices are about three times those prevailing in 1969, they are still grossly below the true value of natural gas. In terms of barrels of oil-equiva-

lent, the world price of energy in 1975 was about \$12 per barrel, but 60-cent gas is equivalent (in thermal content) to oil at \$3.50 per barrel. Thus the price increases that occurred up to and including 1975 were not sufficient to bring the price of natural gas anywhere near its free market level.

In order to avert extreme shortages, the wellhead price of gas had to be increased significantly. Congress failed to pass legislation to deregulate natural gas prices, but instead considered various emergency allocation schemes to deal with the shortages that they recognized were inevitable.⁴ Fortunately the FPC took a step in the right direction in June, 1976, when it announced, in Opinion 770, that the national area rate for new contracts would be nearly tripled to \$1.42 per mcf, with future price increases of 4 cents per annum. This decision was immediately challenged in the courts, leaving the effective price of natural gas in doubt for about a year. However, on June 16, 1977, the United States Court of Appeals for the District of Columbia unanimously upheld the FPC decision.⁵ Thus the new contract price in 1977 averaged about \$1.46 per mcf.

Unfortunately the new FPC area rates still do not go far enough in bringing natural gas prices up to free market levels. Natural gas at \$1.46, for example, is equivalent to oil at about \$8.50 per barrel, again well below the world market price. Also, 4 cents per annum price increases will result in natural gas prices *falling* in real terms (unless the aggregate rate of inflation drops below 3 percent, which is unlikely). As a result, we will continue to be threatened by natural gas shortages. There is thus a pressing need to revise our natural gas policy.

It is important to recognize that any natural gas policy involves a trade-off between two evils—higher prices to consumers, and growing shortages. Evaluating any particular policy thus requires estimating the magnitudes and effects of higher prices, and the magnitudes and effects of shortages, that are likely to result.

WHAT IS AT STAKE—HIGHER PRICES?

It is not surprising that this country's natural gas policy (and for that matter, its entire energy policy) has been dominated by a desire to hold down prices. Policy-makers are not ignorant of the simple economics of supply and demand (although they may have underestimated the impact of price effects). Rather, there has been a strong political incentive to prevent consumer prices from rising and to prevent producing companies from receiving large profits from price increases. In effect, a major goal of our natural gas policy has been distributional in nature; politicians are reluctant to pass legislation that would redistribute income from gas consumers to gas producers. With this in mind, let us consider what might happen to natural gas prices under alternative policies. Three such policies must be con-

³For discussion of these decisions, and estimates of what free market new contract prices would likely have been, see *ibid.*, pp. 15-21.

⁴A House bill and a related administration proposal would have allowed interstate pipelines to purchase gas in intrastate markets if the consuming areas served by those pipelines were expected to have significant curtailments. In the administration proposal, pipelines would have paid whatever free market prices prevailed in the intrastate market, and this higher price gas would be “rolled in” with the lower interstate prices. The House bill (H.R. 9464) would have placed a ceiling on the intrastate price. For estimates of the probable impact of such a plan on interstate and intrastate gas markets, see R. S. Pindyck, “Emergency Proposals to Deal with the Natural Gas Shortage. Testimony before the House Committee on Interstate and Foreign Commerce,” Subcommittee on Energy and Power, September 24, 1975.

⁵*American Public Gas Association et al. vs. FPC*, Decision 76-2000. The Consumer Federation of America may appeal the decision further, but except for the Phillips decision, the Supreme Court has in the past supported FPC authority and methodology in establishing natural gas prices.

sidered, since these have provided the basis for most recent public debate over natural gas regulation.

The first is simply a continuation of current FPC national area rates (which assumes that the FPC does not by itself change this pricing policy). New contract prices would increase by 4 cents per year from the 1977 level of \$1.46. As old contracts expired, average wellhead prices for gas sold on interstate markets would rise but would remain well below new contract prices for several years, only reaching about 87 cents per mcf in 1980. Average wholesale prices (i.e., prices charged by the pipelines to public utilities and large "mainline" industrial consumers) would depend on the particular distribution of gas through the pipeline network and the cost of transmission, which in turn would depend on changing patterns of regional demand. Although we cannot know what these prices will be with certainty, we can predict their likely values.

We can expect these prices to average about 98 cents in 1978, and \$1.16 in 1980. Similarly, based on projected demands and projected interstate supplies, we can project that intrastate wellhead prices would reach \$2.00 in 1978 and \$2.40 in 1980. To project retail prices, we assume that the 1976 average retail to wholesale markup remains constant in real terms on an mcf basis; we then extrapolate the markup assuming a 6.5 percent rate of inflation.⁹ Based on these markups, we estimate that in 1980 average residential retail prices would reach \$2.83, while average industrial retail prices would reach \$1.92. (There will be, however, considerable regional variation.)

A second alternative policy is laid out in President Carter's National Energy Plan (1977). The main aspects of that plan which deal with natural gas are as follows:

a. The new contract price for "new" gas would be set equal to the BTU equivalent of the average refiner acquisition price of all domestic crude oil, while new

⁹This markup is regulated by state regulatory commissions, and is usually based on an allowed rate of return on undepreciated capital. Unless there are major changes in supply, capital requirements are not likely to change much in the future. Assuming that labor costs and nominal interest rates reflect the aggregate rate of inflation, it seems reasonable to assume that the markup will remain constant in real terms, as it more or less has in the past.

¹⁰"New" gas includes new discoveries "from onshore wells more than 2 1/2 miles from an existing well, or 1000 feet deeper than any existing well within a 2 1/2 mile radius," and offshore gas "produced from wells on new federal leases granted on or after April 20, 1977, or old leases which had been abandoned and are subject to re-leasing." See *National Energy Plan* (Washington, D.C.: Government Printing Office, 1977).

⁸These prices are in nominal (undeflated) terms, and based on an assumed 6.5 percent rate of general inflation.

⁹Fact sheet on President's energy program issued by White House Energy Staff and *National Energy Plan*, op. cit.

¹⁰Obtained using our econometric model.

¹¹These retail prices are again based on the markup forecasts described earlier.

contract prices of "old" gas would continue to be limited to existing FPC national area rates.⁷ Based on projections of crude oil prices under the Carter plan, we would expect the price of "new" gas to begin at \$1.75 per mcf and rise to \$2.40 in 1980 and \$3.10 in 1985.⁸ We would also expect "new" gas to account for only about 25 percent of all new contracts in 1978, but nearly 100 percent of all new contracts by 1981. As a result, the average new contract price ("new" and "old" gas) on interstate sales would be about \$1.58 in 1978, and \$2.00 in 1980.

b. New contract prices for intrastate gas would also be regulated. All new contracts of intrastate gas (both "old" and "new" gas) would be tied to the price of "new" interstate gas, i.e., would increase from \$1.75 initially to around \$2.40 in 1980. Average wellhead prices of intrastate gas would thus be below their free market levels, but only for a few years, and not by very much (since the price of "new" gas will rise as the average refiner acquisition price of domestic crude oil rises over the next five years).

c. Pricing policy would discourage the use of gas by industry and electric utilities. The wellhead cost of higher-priced ("new") gas would be allocated to residential rather than industrial users. In addition, beginning in 1979 a tax would be levied on industrial users of gas which would be keyed to the difference between the price of gas and the BTU equivalent price of oil. This tax would increase so that on an mcf basis, the effective industrial price of gas would be \$1.05 below the BTU equivalent price of oil in 1979, and equal to the BTU equivalent price of oil in 1985 and beyond.⁹ Based on projections of oil prices, we estimate that this tax would increase from about 25 cents per mcf in 1979 to about \$1.00 per mcf in 1985. Based on our projections¹⁰ of average wellhead prices and average wholesale prices under the Carter plan, we estimate that the average retail industrial price of gas (including the tax) would be about \$2.39 in 1980 and \$4.07 in 1985. Despite the tax and allocation of higher-priced gas to industrial users, residential retail prices would still be higher because of the relatively high cost of retail distribution to residential consumers: \$2.93 in 1980 and \$4.31 in 1985.¹¹

The third alternative policy is designed to increase the new contract price of all gas toward its free market level over the next five years. This would provide a greater incentive to producers to increase supplies of gas, by exploring for new discoveries (thus increasing reserves of "new" gas), by exploring near and extending existing reservoirs (thus increasing reserves of "old" gas), and by increasing production from higher-cost reserves (that would otherwise be uneconomical). This

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Robert S. Pindyck is coauthor with Paul MacAvoy of *Price Controls and the Natural Gas Shortage* (Washington, D.C.: American Enterprise Institute, 1975).

A Glossary of Gas Energy Terms

BOTTLED GAS

In the industry, liquefied petroleum gas contained under moderate pressure in cylinders. Usually propane and/or butane.

BRITISH THERMAL UNIT (BTU)

The quantity of heat that must be added to one pound of water to raise its temperature one degree Fahrenheit from 58.5 to 59.5° F under standard pressure of 30 inches of mercury.

CONVERSION TO NATURAL GAS

Changing the gas service to ultimate customers from gas other than natural gas to natural gas, including adjustment of consumers' appliances to perform satisfactorily with natural gas. Natural gas does not necessarily mean straight natural gas; stabilizing the heat content of the sendout gas by diluent gases or enriching gases is considered not to change the basic character of natural gas. For the purpose of uniform reporting, a company should be considered a natural gas company when 95 percent of the system has been converted.

DEPLETION ALLOWANCE

A charge against income for the extraction of natural resources, commonly called "wasting assets" (i.e., gas, oil, coal, etc.).

DEPRECIATION

A lessening in the value of an asset, or the expiration in use of the cost or other basic value of property. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the arts, changes in demand, and requirements of public authorities.

GAS, NATURAL

A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

INDEPENDENT

As used in the oil industry usually refers to a nonintegrated producing company. The integrated company usually operates production, transportation, refining, and marketing facilities. The independent producer has operations only in the field of petroleum production, as a rule.

INTERRUPTIBLE SERVICE

Low priority service offered to customers under schedules or contracts that anticipate and permit interruption on short notice, generally in peak-load seasons, by reason of the claim of firm service customers and higher priority users. Unlike off-peak service, gas is available at any time of the year if the supply is sufficient.

LIQUEFIED NATURAL GAS (LNG)

Natural gas which has been liquefied by reducing its temperature to minus 260° F at atmospheric pressure. It remains a liquid at -116° F and 673 PSIG. In volume it occupies 1/600 of the gas in vapor state.

LIQUEFIED PETROLEUM GAS (LPG)

A gas containing certain specific hydrocarbons that are gaseous under normal atmospheric conditions, but can be

liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.

LIQUIDS, NATURAL GAS

Those liquid hydrocarbon mixtures which are gaseous at reservoir temperatures and pressures but are recoverable by condensation or absorption. Natural gasoline and liquefied petroleum gases fall in this category.

NAPHTHA

Any of various volatile, often flammable liquid hydrocarbon mixtures used chiefly as solvents and diluents and as raw materials for conversion to gasoline and substitute natural gas (SNG).

POSTED FIELD PRICE

Price for oil or gas in a given area, set by principal buyers. Price is available to any producer in the area.

PROBABLE RESERVES

In mining industries other than petroleum, the amount of reserves estimated to be available once additional development expenditures are incurred.

RATE BASE

The value established by a regulatory authority, upon which a utility is permitted to earn a specified rate of return. Generally, this represents the amount of property used and useful in public service and may be based on the following values or combinations thereof: fair value, prudent investment, reproduction costs, or original cost; and may provide for the inclusion of cash working capital, materials and supplies, and deductions for: Accumulated Provision for Depreciation, Contributions in Aid of Construction, Accumulated Deferred Income Taxes, and Accumulated Deferred Investment Tax Credits.

RESERVES, ENERGY

Refers to the bank of natural resources, such as natural gas, natural gas liquids, petroleum, coal, lignite, and energy available from water power, and solar and geothermal energy.

Estimated Potential Natural Gas Reserves. Refers to an estimate of the ultimate finding of natural gas in a specified area, whether or not presently considered proved or recoverable.

Estimated Proved Recoverable Natural Gas Reserves. An estimated quantity of natural gas that analysis of geologic and engineering data demonstrates with reasonable certainty to be recoverable in the future from known oil and gas reservoirs, under existing economic and operating conditions. Reservoirs are considered proved that have demonstrated the ability to produce by either actual production or conclusive formation test.

SUBSTITUTE NATURAL GAS (SNG)

A gas manufactured from carbonaceous material whose characteristics are substantially interchangeable with natural gas. The resultant gas is composed primarily of methane. At this writing, SNG feedstocks are the light hydrocarbons, propane, butane and the naphthas. Development of processes is under way for production from heavier feedstocks and from coal.

WELLHEAD

The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and casing of the well so as to control the flow from the reservoir. ■

Excerpted from *Glossary for the Gas Industry* (Arlington, Va.: American Gas Association, 1977).

"The United States has had an energy policy for several decades. It is premised on the increasingly untenable assumption that energy is both cheap and abundant and will grow even cheaper and more abundant with the passage of time."

America's Hidden Energy Policy: Federal Regulation and Taxation

BY ERNST R. HABICHT, JR.

Director, Energy Development Fund Energy Program

ANY government policy dealing with a commodity like energy must be a pricing policy. Prices have incentive effects; that is, they determine the demand for and the supply of goods and services. High prices inhibit demand and encourage investments in new supplies, or (and this is all too frequently neglected) they coax forth new alternatives to traditional supplies. Low prices have precisely the reverse effect.

The government can influence energy prices in a number of ways. For example, it can tax some or all forms of energy and, thereby, raise energy prices. Conversely, it can offer tax incentives for producing energy and thus lower energy prices. The government can also regulate energy prices directly; for the last 24 years it has regulated the price of gas sold in interstate commerce. It can also regulate utilities directly and can thus directly control their prices (rates) and investment decisions. In the last few years, the federal government has also increasingly regulated the oil industry's prices for both crude oil and refined products.

The United States has had an energy policy for several decades. It is premised on the increasingly untenable assumption that energy is both cheap and abundant and will grow even cheaper and more abundant with the passage of time. Over a period of many decades, this assumption—based on the experience of an earlier era—has determined the way we regulate and tax the energy industry. But the assumption is no longer valid. It now severely discourages sound, practical investments in improving the efficiency with which energy is used ("energy conservation") and encourages investments in technologically questionable and economically wasteful energy supplies. It strongly favors existing energy forms—oil, natural gas and large, central station electric generation—while it discriminates against novel but proved energy technologies, like solar energy, which cannot easily be assimilated institutionally with the energy forms we depend on today.

Our present tax codes and utility regulatory policies reward spending money only on conventional energy

supplies or on their very expensive near-substitutes, like synthetic natural gas, regardless of their costs. Of particular importance are the investment tax credits and accelerated depreciation provisions of the federal tax code. And where gas or electric utilities are involved, it is common practice to price them on a declining block basis; that is, the more gas or electricity a customer uses, the lower the cost of additional consumption.

To bring home the reality of current regulatory and tax practices, it is necessary to examine what actions they encourage. Thus the worried manager of a natural gas utility running short of gas for his customers might consider investing in a synthetic gas plant. Such facilities convert hydrogen-rich fuels into methane, the principal constituent of natural gas. A firm supply of feedstock would be procured for his plant (probably naphtha, a close relative of gasoline, or propane, itself used for heating and cooking), a line of financing for the plant itself, would be established, and regulatory approval would be secured at the state or federal level. Since the investment community that provides the new capital for the plant must be confident that it will earn a return on its investment, it must be assured that the product of the plant—the synthetic natural gas itself—will be sold at a price competitive with other fuels, to insure a steady flow of revenues. This is where our energy policy falters.

The cost of, say, naphtha for a synthetic gas plant is roughly \$4.00 for each 1,000 cubic feet (Mcf) produced by the plant. (An Mcf of natural gas contains about one million British thermal units, the energy equivalent of roughly eight gallons of gasoline—enough energy to raise the temperature of about 700 gallons of ice water to the boiling point.) But the average cost of gas for residential use around the nation is only \$2.00 per Mcf. Added to the cost of naphtha is the cost of the labor to operate the gas plant, together with the cost of the plant itself—which has to be repaid over the life of the plant and, of course, carries a hefty annual interest charge. All these things together may bring the cost of synthetic gas to well over \$5.00 per Mcf.

The tax laws help bring this down. While the plant

may have a 25-year physical life, it probably has a tax life that is much shorter. This, together with accelerated depreciation, permits the plant's operators to write off their capital investment entirely in the earlier years of the plant's physical life, and this credit can be deducted from taxable earnings from their composite operations. The investment tax credit, currently at 10 percent, permits them to subtract an additional significant component of investment from taxes owed in the very first year of the plant's operation. As a tax dollar saved is a tax dollar earned, these assorted provisions work to lower the apparent cost of the synthetic gas to the plant's operators—the gas utility—and, under some circumstances, to their customers.

But this is not enough. To secure a line of financing for this plant, its operators need regulatory permission to average in the costs of gas from this facility with the costs of all other gas employed in their operation. They will be able to sell high cost synthetic gas this way as long as: (1) the average cost of gas is low relative to the cost of synthetic gas and (2) the volume of synthetic gas is low relative to the overall volume of gas sold by the utility. Under these conditions, which generally prevail today, average cost or "rolled in" pricing very effectively hides the high cost of the synthetic gas and permits utilities to sell it at a competitive price, a price which is no more than 40 percent of the true costs of the gas produced by the new plant. And even this overstates the cost of using more gas for many customers.

What does this mean for the country as a whole? Any additional demand for oil or oil-derived products like naphtha must be met with imported petroleum, either in the form of crude oil or in the form of refined petroleum products. When a synthetic gas plant goes into operation, the naphtha it uses must—directly or indirectly—be imported, most probably from Saudi Arabia, the one nation with a large amount of excess oil-producing capacity. Imagine a pipeline connecting oil in Saudi Arabia to water heaters and industrial furnaces in Indiana, fitted with a mysterious economic valve that somehow lowers the apparent cost of fuel by at least 60 percent along the way. Does this sound like an absurd fiction? Probably so. But there are already over a dozen such plants in operation today, and more are proposed each year by gas utilities around the nation. Their construction and operation is actively encouraged by our real but invisible energy policy, which manages to hide the costs of energy-related industry in the United States except in the economy, where the true costs of synthetic gas appear in the form of inflation, unemployment and balance of payments deficits.

Nonetheless, some people and some companies need natural gas, and the United States is running short of it. Does the federal government have an obligation to provide them with gas? After all, in many areas new gas service is being refused and customers must heat

their homes and their water electrically—a process that is far more costly than heating with gas, even if the price of gas is doubled. And what about industries which convert gas into useful chemicals and even insulation—should these customers be guaranteed a firm supply of natural gas?

This leads to another question. At what price do consumers need additional natural gas? Does it make any sense to provide them \$2.00 gas that costs \$5.00 or more? In particular, does it make any sense to sell gas at a very low price when raising that price would encourage fuel-switching on the part of large, flexible customers who could use coal or even burn oil directly (not as difficult in comparison to refining heavy oils to naphtha and then turning that naphtha into synthetic gas). Indeed, in some gas utility service territories, there is a potential for considerable such fuel-switching if the price of gas is maintained at about \$2.50 to \$2.75 per Mcf, which price is far below the cost of synthetic gas, imported liquefied natural gas, or gas derived from coal gasification. Such fuel-switching should be encouraged wherever possible, in the hope that the gas shortage will disappear or at least diminish so that our gas utilities can resume a program of technically rational, economically sensible investment.

One good way to approach this is to turn the existing gas rate design on its ears—essentially to invert it—so that the more gas consumed in a given billing period, the higher the unit cost. This should apply to all customers, not merely industrial customers, to encourage sensible investment in gas conservation wherever possible and to reward customers who conserve. Current regulatory practices and rate designs make this virtually impossible, but such practices are not immutable.

HOW OUR POLICY ENCOURAGES WASTE

Today, the average price of gas around the nation is roughly \$2.00 per Mcf—a price equivalent to gasoline at 26 cents a gallon. This is very cheap, indeed; nonetheless, gas rate-making policy under the aegis of state regulatory authorities tends to make gas even cheaper. While the average price of gas may be \$2.00, the declining block rate currently in effect in most regulatory jurisdictions makes gas a real bargain to a consumer who is already using some gas and decides to use more. Decisions to use more gas (or, for that matter, to save gas) under a declining block rate are undertaken in the final, not the average, block of consumption—at a price level well below the \$2.00 residential average price. This is so by definition; under a declining block rate design, the rate level of gas declines with increasing consumption. Moreover, large industrial and commercial customers usually pay a considerably lower average rate than residential customers. So their decisions to consume or conserve may be made at a much lower price level than the misleading average price of gas.

As for synthetic gas, an industrial customer served by a gas utility planning a new synthetic gas plant may be making decisions to consume or conserve gas at a rate level as low as \$1.25 per Mcf—while the utility is about to provide him with additional gas at a cost *four times* the price he is paying for it. To understand the implications for energy conservation, consider this in reverse. If an industrial customer were paying \$1.25 for gas in his final block of consumption, then an investment in improving the efficiency with which that gas is utilized at the industrial plant would produce savings equal to \$1.25 for each Mcf conserved. But added gas really costs \$5.00 per Mcf; thus there is an additional saving of another \$3.75 worth for each Mcf, whenever gas is conserved. Where does this money go? Under regulation, this lion's share of savings would flow to all the other utility customers—who made no investment in energy conservation whatsoever. This is a pernicious policy and means that energy conservation that is economically justifiable and in the interests of the nation as a whole must depend largely on altruism.

A colleague, W.R.Z. Willey, has investigated the consequences of energy conservation for electric utilities and their customers. In this case, the supply of electricity is extraordinarily capital-intensive, requiring disproportionately large fixed investments to produce a given sales volume. Thus the tax laws that bear on new capital investments play an unusually significant role in the electrical energy sector of our economy. In testimony before the California Public Utilities Commission, Willey demonstrated that, while ratepayers and stockholders of an investor-owned electric utility benefit from reduced utility construction outlays (by relatively lower rate levels and lessened dilution of common stock values, respectively), for some years the principal savings accrue to federal income taxpayers by virtue of reduced utility investment tax credits and accelerated depreciation allowances.

In other words, in the early years after investment in a device that saves electricity and allows the deferral of new utility plants, the bulk of the savings flows back to taxpayers who made no investment whatsoever. The reverse of this is also interesting. When an electric utility invests in a new plant, one of the major contributors to that investment is the federal income taxpayer, who must pay higher taxes to offset the deductions made available to the utility. Studying numerous regulatory proceedings around the nation over the last seven years, I have yet to see any group that purports to represent the interests of federal income taxpayers in such proceedings.

WHAT SHOULD OUR ENERGY POLICY BE?

Numerous predictions of "energy futures" are now available and, depending on one's philosophical inclinations, conditioning or self-interest, very different technological outcomes can be selected. Such predictions

are suspect, however, because forecasters have not told us how we actually arrive at the outcome they predict at some variable future date. Regardless of our "energy future," however, we will have to graft new energy hardware onto the existing energy infrastructure, with the goal of minimizing the combined economic and environmental costs of providing or saving energy.

Yet a study of our gas and electric utilities—and the oil industry is increasingly regulated so that it looks more and more like a utility each day—indicates that it will be impossible to hold costs to a minimum in the attainment of any future energy economy. Our hidden but very real energy policy, predicated on cheap and abundant energy, prevents us from acting sensibly and strongly encourages waste—waste of both energy and capital—which translates quickly into the loss of economic well-being for the nation as a whole.

NEEDED REFORMS

Studies made by the Environmental Defense Fund recognized more than six years ago that if sound economics were applied to the nation's energy policy, the reforms would benefit the environment and energy users, both large and small. Our suggestion of time-of-day pricing for electricity became a central feature of national energy policy reform under Presidents Gerald Ford and Jimmy Carter, and is now being implemented by a growing number of electric utilities. Time-of-day pricing encourages innovation to cut electric utilities' costs and to deploy new technologies. One good example of this is solar energy.

Electricity is expensive to produce at some times of the day or year and is relatively inexpensive at others, because at or near maximum periods of electrical demand a utility is compelled to sell power from those generating units having high fuel costs. In addition, it is encouraged to build new plants in order to secure the capacity to meet expected increases in peak demands. On top of this, the efficiency losses in power generation, transmission and distribution escalate sharply as overall demand increases. In contrast, added demand during off-peak periods requires far lower expenditure per unit of electricity generated and imposes no requirement for additional electrical generation, transmission or distribution capacity.

A sensible solar energy policy would, among other things, encourage those particular solar techniques that reduce peak electrical demands. But the most efficient solar investments—those that cut conventional utility costs the most per dollar invested—can only occur if the utility lets the solar energy industry and its potential

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AMERICA'S HIDDEN ENERGY POLICY: FEDERAL REGULATION AND TAXATION

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customers know when it is expensive to produce power and when it is not.

The key determinant of the worth of energy alternatives—new supplies, conservation or innovation in general—is the marginal cost of the energy form under scrutiny. Marginal cost is defined as the cost of providing a little more energy. This, by definition, must be equal to the economic saving that comes from using a little less. (Marginal cost is distinguishable from average cost because the latter is the total cost of all units used, divided by the total number of units.) During peak periods of demand, like hot summer weekday afternoons or cold winter evenings, the marginal cost of electricity is high, and during off-peak periods, at night or during weekends, the marginal cost is low. Only if electric rates reflect these cost differences can we expect the solar energy industry (or any other innovators) to respond to reduce marginal energy costs when they are highest. Yet the electric utilities persist in basing their rates on their average costs and letting them decline with the increasing volume of use. The reform suggested here is to premise the price of electricity on the time of its consumption rather than on the volume used by any particular customer.

SOLAR ENERGY COSTS

While solar installations must stand on their own feet (unsupported by anything cheaper to hide their costs), new, expensive electricity or gas supply facilities can disguise their costs by means of average cost pricing. In addition, the tax laws service the electric and gas utilities very well indeed, but ignore the solar energy industry. This is one reason why some observers say that solar energy is years away, while others believe that its day could be moved much nearer. The same considerations apply to various estimates of the value of energy conservation in general. This discrepancy generates a lot of confusion, but the main reason for widely differing opinions is that some analysts ignore our hidden energy policy, while others recognize it and believe that it must be scrapped if we are ever to attain a new sensible energy policy.

Some steps have already been taken in the right direction. Some state regulatory authorities—most notably Wisconsin, New York and California—have adopted more rational electrical rate-making policies. Several states are considering similar proposals for natural gas. At the federal level, the administration may also be considering suggestions for changing gas pricing policies and attorney tax treatment of energy conservation and solar energy.

What constitutes a sensible energy policy? It should minimize total energy costs, both economic and environmental. To accomplish this, we should invest in new energy supplies in the relative order of their increasing costs. Potential supplies include conserved energy—energy derived from using what we have more efficiently. After all, the only distinctions made between a barrel of oil saved and a barrel produced from a new drilling venture are institutional. The two barrels cannot be physically distinguished. In virtually every instance, a barrel of oil or an Mcf of gas saved is far cheaper, both economically and environmentally, than a barrel of oil or an Mcf of gas derived from a new well.

Another critical but generally neglected element of a successful energy policy is that it must foster innovation. We need to encourage the very best ideas and to develop and commercialize the most effective technologies if we are successfully to hold the costs of energy to an absolute minimum. Average cost pricing is a death sentence for innovation, as is any tax policy that subsidizes, often open-endedly, only tried and true energy forms and ignores the novel and adventuresome. Innovators and risk-takers respond mainly to price incentives. Although innovation is the well-spring of our future economy, our existing energy policy ignores innovation and thereby discards the principal strength of our free enterprise system.

SUMMARY

There are certain fundamental principles that—sooner or later, and the sooner the better—must be the foundation of a successful energy policy. But, sadly, the attention of the nation's policymakers is focused elsewhere. For example, the debate over deregulating natural gas producers' prices has focused too much attention on a single thread of the fabric of energy policy, ignoring the fact that every pipeline has two ends. It is silly to concentrate on the economics and technology of one end—the gas producers—and not take a hard look at the other end—the gas consumers.

Average pricing and open-ended tax subsidies that so perversely obscure the cost of energy must end. After all, consumers can save money by using less energy; they cannot reduce their taxes in the same way. But no matter whether our present energy circumstances are called a crisis, a shortage, or a hoax, new policies regarding energy are far more important than most consumers recognize.

The energy situation that has attracted so much attention recently will soon appear in other sectors of our economy, most notably, raw materials and water. Thus the policies accepted for energy will probably provide the keystone for reforms in other sectors of the economy. In a very real sense, a mistaken energy policy is a prescription for national disaster not only for energy but also for water, raw materials and other natural resources. ■

THE U.S. OIL INDUSTRY

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tion, the greater the probability that firms will behave cooperatively rather than competitively.

The consensus among experts is that a four-firm concentration ratio of 50 percent or more is a reasonable estimate of the point above which tacit collusion is probable.¹³ According to this measure, the petroleum industry is only moderately concentrated and basically competitive. None of the major sectors of the industry has a four-firm concentration ratio in excess of 50 percent, as shown in Table 4. And both the four-firm and eight-firm concentration ratios of the oil industry compare favorably with other sectors of the American economy. The concentration ratio is highest in the area of oil reserve holdings, where the top 20 companies hold over 93 percent of proved domestic reserves. But the difficulties in obtaining proved reserves data make these estimates difficult to compare over time.

Petroleum production is the one sector where the large companies have gained an increasing share of the market over time, but major portions of this sector are still dominated by smaller firms. Oil exploration, for example, has long been the province of independent companies—in 1974 those firms not in the largest 30 in the country drilled over 80 percent of all exploratory wells. There has been a capital barrier to market entry in the petroleum refining sector which has forced higher concentrations (a large refinery can cost almost \$1 billion) but some 60 firms managed to enter the refining business over the last 25 years. And although there has been some erosion of small companies in petroleum products retailing (particularly in the sale of gasoline), the independents continue to be a force in cutting costs in oil marketing.¹⁴ Not included in Table 4 is the petroleum transportation sector, in which oil companies own about one-third of all private tanker capacity and about 50 of the 100 oil pipelines subject to federal regulation. The tanker industry appears to be relatively competitive because market entry is easy, and the pipeline industry is also basically unconcentrated (the top four interstate pipelines control only 23 percent of the market):

The proponents and opponents of federal regulation

¹³Jesse W. Markham, Anthony P. Hourihan and Francis L. Sterling, *Horizontal Divestiture and the Petroleum Industry* (Cambridge, Mass.: Ballinger, 1977), pp. 1-5.

¹⁴Barbara Hobbie and Richard B. Mancke, "Oil Monopoly Divestiture: A Clash of Media Versus Expert Perceptions," *Energy Policy*, vol. 5 (September, 1977), pp. 232-244.

¹⁵John M. Blair, *The Control of Oil* (New York: Pantheon Books, 1976), p. 151.

¹⁶U.S. Senate, Committee on Energy and Natural Resources, Subcommittee on Energy Research and Development, *Petroleum Industry Involvement in Alternative Sources of Energy* (Washington, D.C.: Government Printing Office, 1977), pp. 8-9.

of oil firms agree that there are two important aspects of petroleum resource development that are exceptions to the overall competitive nature of the industry. First, the high costs of producing oil from Alaska or the OCS favor the large companies that can pay the initial capital investment. As an example of this constraint on competition, Exxon Corporation was the apparent high bidder in March, 1978, on 21 tracts off the coast of Georgia with a total bid of \$34.4 million. Second, because of these capital barriers, many OCS or Alaskan developments have been undertaken as joint ventures. While these tactics enable companies to pool costs and share risks, joint ventures are substantial threats to competitive behavior.

Those areas of competitiveness where there is no agreement among experts are perhaps the most significant. For the basic thrust of the charge of anticompetitive behavior in the petroleum industry rests on other factors in addition to concentration. According to this thesis, concentration in the oil industry is supplemented by "a complex of intercorporate relationships imparting to separate companies a cohesiveness and commonality not approached in any other industry."¹⁵ Included in these intercorporate links are interlocking directorates and exchange and processing agreements. Unfortunately, there is almost no reliable or credible data to indicate the effects of these mechanisms on oil industry competitiveness. About the best that can be said is that such relationships are difficult to analyze and would be even more difficult to regulate effectively.

Of more recent vintage than the controversy surrounding vertical integration is the issue of the horizontal integration of oil companies. By 1970, of the 25 largest oil companies, 18 were involved in oil shale activities, 11 in coal, 18 in uranium, and 7 in tar sands. But concern has focused on only two of these alternate energy resources—coal and uranium—because they represent the best short-term substitutes for petroleum. As of 1977, about 60 separate oil companies held approximately 21 percent of existing coal reserves and 17 percent of coal production capacity. At the same time petroleum firms controlled 48 percent of United States uranium reserves and 44 percent of uranium production. While the growth of petroleum industry ownership of coal resource development activities over the last few years has been steady, there does not appear to be any immediate threat to competition in a sector that also features active participation by steel companies and electric utilities and that has the largest domestic resource base. Such is not the case with regard to the uranium sector. The horizontal integration of oil firms in uranium resource development is at a dangerously high level. This is especially the case in uranium mining and milling (processing) operations, where the top five oil firms control about 68 percent of national uranium milling capacity and the top four petroleum companies hold over 42 percent of known uranium reserves.¹⁶

OIL INDUSTRY INCOME REDISTRIBUTION

Finally, the oil embargo coincided with rapid increases in industry profits. During 1973 the ten largest oil companies increased earnings by an average of 48 percent over the previous year. And these profit increases continued for most petroleum firms into 1974; the industry as a whole reported profits for the first half of 1974, 60 percent higher than for the first half of 1973. These rates of increase rekindled accusations that the industry had used its economic and political power to manipulate fuel prices. Throughout 1974 and 1975 opinion polls showed increasingly strong public support for government control of corporate profits in general and for regulation of oil company profits in particular; by mid-1975 as many as seven people in ten favored restrictions on oil industry profits.¹⁷ But by 1975 the industry's profits had already begun to erode. By the last quarter of 1974, a combination of government policies—particularly the removal of the percentage depletion allowance—and decreasing demand led to rapid declines in profitability for the large firms. For the first and second quarters of 1975, profits were more than 30 percent lower than the same period during the previous year.

And in retrospect, the rates of return to the oil industry were about the average for all United States industries. Using the most common measure of profitability—the return on stockholders' equity—the oil industry does not appear to have exercised substantial influence over profits. The rate of return for the oil industry over the five-year period prior to 1974 was 11.0 percent, compared to an average for all manufacturing industries of 11.3 percent. And although the rate of return for the largest oil firms has climbed to about 14 percent since 1975, this represents the same profitability level the industry enjoyed in 1956.¹⁸

Despite the decline in industry profits, the income redistribution controversy has not gone away. Instead, the issue of industry "windfall," or "inventory" profits has been a primary rationale for the Carter administration's controversial decision to maintain price controls on crude oil and its products for the immediate future. A cornerstone of the National Energy Plan is the income redistribution issue:

Pricing policies should encourage proper responses in both the consumption and the production of energy, without creating any windfall profits. If users pay yesterday's

¹⁷Opinion Research Corporation, *General Public Attitudes and Behavior Toward Energy Saving: Highlight Report, Volume IX* (Washington, D.C.: Government Printing Office, 1975), pp. 5-6.

¹⁸See Edward W. Erickson, "Charges of Domestic Energy Monopoly: The Dog in the Manger of U.S. Energy Policy," in Frank N. Trager, ed., *Oil, Divestiture and National Security* (New York: Crane, Russak and Company, 1977), pp. 48-53.

¹⁹Executive Office of the President, pp. x-xi.

prices for tomorrow's energy, U.S. resources will be rapidly exhausted. If producers were to receive tomorrow's prices for yesterday's discoveries, there would be an inequitable transfer of income from the American people to the producers, whose profits would be excessive and would bear little relation to actual economic contribution.¹⁹

In fact the National Energy Plan is a classic example of the drive toward social regulation of the oil industry. According to the plan, the context within which national energy policies must be formulated is dependent on a government that accepts responsibility for dealing with energy in a comprehensive manner. And this responsibility is assumed to include the requirement for tools such as price controls to "ensure competition in the energy industries generally and among the major oil and natural gas companies in particular" and to guarantee equitable income redistributions from national energy policies. And, at least in part, the opposition to the plan that has thus far blocked its implementation can be seen as the result of the problems discussed above; the nation continues to struggle with the conflicting pressures for resolving the petroleum supply-and-demand dilemma and the regulatory stalemate that underlie the energy crisis of the 1970's. ■

THE PRIVATE CONSUMER

(Continued from page 201)

President Carter's NEP includes such items as a "gas-guzzler" (excise) tax on inefficient cars, a rebate on efficient automobiles and a tax on new cars that perform below the fuel economy standards.¹¹ Those standards are now set for a fleet average of 27.5 mpg by 1985. Despite the NEP, the exact energy program, in areas like price regulation, performance standards, and mandatory fuel switches for utilities and industries, and "carrot-and-stick" tax incentives and disincentives, is still to be hammered out by Congress.¹²

Within the private sector, there are numerous examples of how conservation is being supported and promoted with an eye to the individual consumer. Stores have reduced their indoor lighting levels without any

¹¹The National Energy Plan has been carefully analyzed in United States Congress, Office of Technology Assessment, *Analysis of the Proposed National Energy Plan* (Washington, D.C.: Office of Technology Assessment, June, 1977, pre-publication draft).

¹²When strikes threatened New York City subways and buses and the Long Island Railroad at the end of March (1978), Mayor Koch announced a number of restrictions on cars coming into the city should such strikes occur, including: the barring of any auto in much of Manhattan with only a driver; mandatory car pooling and special parking facilities; and a ban on cars with fewer than four occupants from seven major city roads during morning rush periods. The *New York Times*, March 31, 1978. In times of crisis, such sweeping rulings may increasingly be brought to bear in the transportation sector.

hardship to customers—most never notice the readjustment. In Colorado, for instance, the banking community has issued a special energy supplement on a special energy-consumption loan program with its annual report.¹³

In the latter case, loans for the purchase of cars with an EPA-rating of 20 mpg in the city are made at 10 percent interest instead of the usual 12 percent. Similarly, home improvement loans for such purposes as re-insulating, solar application, and other energy-saving projects are extended at 10 percent interest rather than at the usually 13 to 14 percent rate. Phone transfers, the automated clearing house association (through which social security, pension, and salary checks as well as loan payments and the like are made automatically), and other services are geared to reduce the number of trips a customer will make to the bank.

Moreover, the RTD (Regional Transit District) in the Greater Denver area allows free rides during low-use period. And, as an example to the rest of the country, the establishment of bike paths along Colorado roads will lessen the hazards for both car drivers and bicycle riders. Approximately 50,000 miles of bikeways have already been built in the United States.¹⁴

Nonetheless, the capacity of individual consumer's performance is closely tied to the availability of sufficient information on energy issues, both for broad, policy-oriented and medium- to long-term issues and for more specific items where an immediate judgment is pending, as in purchasing an appliance.

Second, the attitude which equates economic growth (standard of living) with high energy consumption should be corrected. Sufficient evidence exists that this is not a sacrosanct, even a valid linkage. Indeed, studies by the Organization for Economic Cooperation and Development (OECD) indicate that lower energy consumption does not automatically bring a drop in the living standard.¹⁵ And recent statistics coming from the industrial sector in the United States reveal that it is possible to increase production without burning the amount of fuel previously thought necessary.¹⁶ A change in, say, a production process for industry or in the life

style of an individual need not be considered negative.

If the United States fails to reduce its energy (specifically, petroleum) demands, the alternatives are far from pleasant. Higher consumption of energy will require ever greater imports of petroleum with resultant deficits in the country's balances of trade and payments, heavy pressure on the dollar, and more inflation. In comparison, conservation is appealingly painless. Moreover, even if the American economy could continue to handle the oil import bills caused by undiminished demand growth rates, the ultimate issue confronting the private consumer, at home and everywhere abroad, is that oil and natural gas are a finite resource. ■

THE ROLE OF THE INTERNATIONAL OIL COMPANIES

(Continued from page 205)

(solar, thermal, as well as strip mining of coal), and the recasting of their corporate image as "energy companies," rather than oil companies, still faces considerable opposition. The proponents of soft energy sources are concerned that the major companies may suppress rather than encourage new technologies. The validity of this concern can only be tested by events; to date, small companies with innovative technology seem remarkably successful in getting it to a receptive market.

The oil companies are confused, with little understanding of where they will be five years hence. As the chairman of Exxon recently wrote:

It is very likely that more drastic shifts in the energy picture will occur in the coming years. Changes in pricing mechanisms, tax policy, patterns of consumption and conservation, in our very life styles, could render the energy situation of the 1990's virtually unrecognizable from what preceded it.⁸

Even the leaders of the powerful majors do not pretend to read the future. They attempted to control the oil situation and, indeed, they were largely successful for 40 years. Now political and economic pressures are ensuring that their control is quietly slipping away. ■

⁸C. C. Garvin, Jr., "Energy Situation to Change by 1990," *Oil and Gas Journal Petroleum* 2000 (August, 1977), p. 496.

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(Continued from page 223)

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¹³The United Bank of Denver issued the energy supplement and the United Bank of Boulder has instituted the reduced-rate loan program for energy-related projects described.

¹⁴Each year since 1972, more bikes than autos have been sold in the United States. The benefits of bike riding, aside from exercise for the public's health, include: higher parking efficiency (20 bikes can be parked in the space of one car); about 100 bicycles can be made from the material required for the manufacture of a single auto; and the annual upkeep for a bike is in the neighborhood of \$50 compared to \$1,170 for a car. "Pedal power" has its disadvantages for long trips or with harsh weather conditions, but bicycles are growing in popularity and use in this country.

¹⁵El Mallakh, *op. cit.*, offers statistics and résumés of the OECD studies and findings.

¹⁶*Christian Science Monitor*, March 24, 1978, carries this report in its editorial, "Saving Oil—and Still Growing."

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VIRGINIA C. KNIGHT ■

THE AMERICAN COAL INDUSTRY

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mates. The apparent expected cost of synthetic gas is above \$3.00 per MBtu for low-Btu processes, and above \$4.00 per MBtu or higher for high-Btu processes. Only the latter make an acceptable pipeline gas. The cost of coal liquefaction is likely to be even higher. Thus, the prospective synthetic oil prices lie above \$24 per barrel, or twice the cost of current natural oil at the margin.

Some interesting conclusions can be drawn from these comparisons. First, none of the processes currently under research for coal conversion will make a competitive boiler fuel. Second, none of them will produce competitive final fuels for large-scale distribution to consumers. Nor will they be suitable for power generation. Third, extensive synfuel expansion can be foreseen for small-scale utilizations industrially, where the direct use of synfuels from inexpensive local coals offsets the costs of distribution of rival natural gas or oil. This could amount to significant energy from coal by 2050. By that time, however, the prodigal amounts of coal required for the generation of electric power and more conventional direct uses would force the consideration of nuclear power, even if it were both more expensive and more hazardous than coal.

Thus, in the long run, certainly within the next 100 years, the use of non-fossil fuels must be developed in the United States or the future growth of the country will be in jeopardy. Long before then, serious environmental problems from coal production and consumption could raise the costs of its expansion. For all these reasons, coal is a transition fuel, enabling the economy safely and relatively cheaply to buy time to develop cleaner non-fossil energy sources. The obvious candidate is not solar power or the breeder reactor but nuclear fusion.

For the producing states, the implications of coal in

transition seem clear. A state like West Virginia would derive more value added from its coal industry in 2000 than it does from all its current economic activities. Because the reserves of coal in such states are vast, the resource values generated will provide a very large base for taxation. Employment and income generated will raise the standards of Appalachia above living standards elsewhere. Moderate severance taxes can provide for the social costs of mining, and their prudent application should suffice to prevent the boom-and-bust effects of past industry declines from impoverishing the region once reserves are depleted.

As in the past, the future of bituminous coal and its lower rank cousins will depend greatly on the technical changes affecting its production and use and rival technologies. Looking forward, few observers in 1890 would have predicted the stagnation and eclipse of the industry 50 years later. Looking ahead, few observers in 1970 predicted its revival and, indeed, its dominance by the year 2000. Today, one can be sure that coal will revive and dominate the domestic energy scene until the problems of other fuel choices can be resolved. How long reliance on coal in transition will last after the turn of the century is difficult to forecast. For this reason, a prudent use in consuming regions and a wise policy of taxation in producing regions is recommended. In the long run, a non-fossil energy source will be necessary. ■

ENERGY AND THE ELECTRIC UTILITIES

(Continued from page 214)

just the fissionable part of our naturally occurring uranium.

If uranium were very plentiful and cheap this would be no great loss. Unfortunately this is not the case. Industry observers estimate that without plutonium recycling and the breeder reactor, the nation's proved and probable uranium reserves are capable of meeting the lifetime needs of only about 300 nuclear power plants.¹⁸ This is a far cry from the limitless resource we have been accustomed to thinking about; it represents perhaps one-third of the nation's electric generating capacity needs in the year 2000; or at most 20 percent of the nation's energy needs in that year. Yet with nuclear moratoria possibilities, delays in licensing, delays in construction, and difficulties in financing, this could represent an upper limit for the contribution of nuclear power to the nation's future energy needs. To the extent that nuclear power is curtailed, other, more expensive alternatives will be needed. ■

¹⁸See M.L. Baughman, and J.B. Gordon, "The Economics of the Throwaway Fuel Cycle," in R.S. Pindyck, ed., *Advances in the Economics of Energy and Resources*, Vol. 1, *The Structure of Energy Markets* (Greenwich, Conn.: Jai Press, 1978).

THE NATURAL GAS INDUSTRY

(Continued from page 217)

policy would raise the new contract price in steps, to \$2.00 in 1978, \$2.40 in 1979, \$2.55 in 1980, \$2.70 in 1981, with further increases of about 20 cents per year (to keep pace with general inflation). As a result of this policy, average interstate wellhead prices would rise to 80 cents in 1978, \$1.30 in 1980, and \$2.21 in 1985, while new contract intrastate wellhead prices would rise to \$2.55 in 1980, and \$3.50 in 1985. Using an econometric model, we project average wholesale prices to be \$1.06 in 1978, \$1.53 in 1980, and \$2.32 in 1985. Finally, average residential retail prices would be \$2.53 in 1978, \$3.20 in 1980, and \$4.61 in 1985, while industrial retail prices would be \$1.73, \$2.29, and \$3.36 in the respective years.

Although these different policies would have very different implications for new contract prices (particularly in later years), in terms of percentage differences the impact on retail prices is much smaller. For example, in 1985 new contract interstate prices under phased deregulation would be about double those under FPC area rates. Average residential retail prices, however, would only be about 22 percent higher. The reason is that the largest component of the residential retail price is the cost of local transmission and distribution, and this cost would not change as wellhead and wholesale prices increased. The percentage increase in industrial retail prices would be larger; by 1985 phased deregulation would result in prices 33 percent higher than under continued FPC area rates, while the Carter Plan would result in prices 61 percent higher (largely because of the tax on industrial use of gas). Finally, note that there has been, and is likely to continue to be, considerable regional variation in retail prices. Part of this variation is due to the differences in interstate transmission costs, and part is due to differences in local distribution costs.

Nonetheless, there is no doubt that our three alternative policies imply significant differences in retail prices of gas to residential and to industrial consumers. The relevant question, however, is what is the total cost to consumers of a higher price policy and how does it compare to the cost of shortage resulting from a lower price policy. Under the Carter Plan, "new" gas prices, which rise from \$1.75 to \$2.40 in 1980, are the relevant new contract prices for determining exploratory drilling and new discoveries, while "old" gas prices are the relevant new contract prices for determining extensions and revisions of gas reserves. Average new contract prices (which determine average wellhead and average

wholesale prices) are calculated by assuming that the fraction of "new" gas in new contracts rises from 25 percent in 1978 to 100 percent in 1981. Intrastate prices begin at \$1.80 in 1978, but reach \$2.40 by 1980. Finally, a tax is added to the wholesale price of gas facing industrial consumers. This tax ranges from 25 cents per mcf in 1979 to \$1.00 in 1985.

The Carter plan would help considerably in reducing excess demand. It would have its effect largely by reducing the demand for natural gas. Since industrial consumers account for the majority of total gas demands, and since they have a higher elasticity of demand, the imposition of a tax on those consumers would cause a major shift to alternative fuels, as well as some decrease in total energy consumption. Under the Carter plan, total demand for gas would decrease by about 10 percent over the next nine years, whereas it would increase by about 30 percent if current FPC area rates are maintained. Unfortunately, while the Carter plan would result in some increase in new discoveries, it would not succeed in bringing forth significant new supplies of gas.¹² Wellhead prices would rise only slowly, and producers would have little incentive to do additional exploratory drilling, or to extend existing pools and reservoirs. The net result would be an increase in excess demand to a peak of 9 Tcf by 1980, and then a slow decrease to about 7 Tcf in 1985. In fact, this plan would still result in significant shortages.

A regulation-induced shortage only makes sense from the point of view of total public welfare if the gain to consumers from lower prices exceeds the losses created by the shortage. In the case of natural gas, continued regulation-induced shortages cannot be justified, since the cost of these shortages would far outweigh the gain that some consumers would receive in lower prices.

We have, of course, ignored the question of *which* consumers would end up paying higher prices under deregulation. There is no doubt that even a moderate increase in the residential price of natural gas would result in an unacceptable increase in the living expenses of some low-income consumers. But the use of energy policy is the wrong way to achieve equity in income distribution and living standards. Distributional goals can be better attained through the use of tax and transfer policy. For example, expanding our existing food stamp program—by increasing stamp allotments and allowing the stamps to be applied to heating bills (or that portion of rent allocated to fuels)—would be an effective way of buffering low-income groups from the effects of higher energy prices.

We have already incurred unnecessarily higher costs from the regulation-induced shortage of natural gas. Hopefully, our energy policy in the future will be guided by a better understanding of the trade-off between the cost of higher prices and the costs of the shortages, distortions, and growing foreign dependence that result from policies that attempt to maintain low prices. ■

¹²Although exploratory drilling is about the same under FPC and Carter, under the President's plan more of that drilling would be directed toward higher risk and higher return areas, so that discovery sizes would be larger.

TWO MONTHS IN REVIEW

A Current History chronology covering the most important events of March and April, 1978, to provide a day-by-day summary of world affairs.

INTERNATIONAL

African Conference

Mar. 25—Rhodesian insurgent leaders and black African leaders arrive in Dar es Salaam for a 2-day conference on the proposed Rhodesian settlement.

Arab League

Mar. 29—At the close of an Arab League council meeting in Cairo, the League condemns "aggressive" Soviet and Cuban intervention in the Horn of Africa (without specifically naming either party) and promises military and other aid to Somalia if she is attacked. Somalia is a member of the League.

Arms Control

Mar. 13—In Washington, D.C., officials report that Soviet negotiators at Geneva have been offering some sensitive information on Soviet strategic missiles, thus removing a block in the negotiations.

Mar. 21—The Geneva disarmament talks recess for 1 month.

Apr. 21—In Moscow, U.S. Secretary of State Cyrus Vance and Soviet Foreign Secretary Andrei Gromyko end 2 days of conferences.

Apr. 22—In a joint communiqué, the U.S. and the Soviet Union report progress on a strategic arms limitation treaty. Vance returns to Washington, D.C.

Belgrade Conference

Mar. 8—At the close of the Belgrade Conference on European Security and Cooperation, a document is approved that does not mention human rights or other controversial issues.

Mar. 9—As the conference ends, the Soviet delegate charges that Western diplomats turned the conference into an "arena of ideological confrontation."

Central Treaty Organization (CENTO)

Mar. 31—A former Turkish ambassador to Athens, Kamuran Gurun, is named secretary general of the Central Treaty Organization, an alliance made up of Great Britain, Turkey, Iran and Pakistan.

East-West Conference on Troop Reductions

Apr. 19—After 4½ years of negotiation in Vienna, NATO officials offer important concessions labeled by the Communist diplomats as a "major new initiative"; a 4-week recess begins.

European Economic Community (EEC)

Apr. 7—Meeting in Copenhagen, EEC leaders agree to hold the first direct elections for the projected European Parliament between June 7 and June 10, 1978. The 410 members of the Parliament will be elected in each member country from members of existing national Parliaments.

Apr. 8—EEC leaders agree on a plan calling for closer coordination of European currencies and a faster rate of

economic growth, as a protection against the fluctuations of the U.S. dollar. The plan will be discussed with U.S. President Jimmy Carter and Japanese and Canadian leaders in Bonn in July.

International Terrorism

Mar. 14—In Assen, the Netherlands, 60 antiterrorist Dutch marines free 70 hostages held for 2 days by South Moluccan terrorists. Yesterday 1 hostage was shot; in the raid that freed the hostages, 6 hostages were wounded and all 3 terrorists were captured.

Mar. 27—Belgian industrialist Baron Edouard-Jean Empain is freed in apparently good health by kidnappers who seized him January 23. No ransom was paid.

Middle East

(See also *Intl. U.N.; Israel; Lebanon*)

Mar. 4—It is reported in Washington, D.C., that Israeli Prime Minister Menahem Begin has told the U.S. Israel will not accept the U.S. interpretation of U.N. Resolution 242; the U.S. maintains that the resolution obligates Israel to withdraw from at least part of the West Bank of the Jordan and the Gaza Strip.

Mar. 5—It is reported in Tel Aviv that Begin has secretly urged Egyptian President Anwar Sadat to resume direct negotiations with Israel.

Mar. 8—Sadat says that U.S. President Jimmy Carter should state his terms for ending the Middle East stalemate.

Mar. 9—President Carter declares that Israel's refusal to comply with U.N. Resolution 242 would be "a very serious blow" to the prospects of peace.

Mar. 11—In a Palestinian terrorist attack on the outskirts of Tel Aviv, more than 20 Israeli civilians are killed when a bus is blown up; the terrorists attacked Israel by boat. Begin postpones his U.S. visit.

Mar. 13—Begin warns that Israel will retaliate for the terrorist raid.

Mar. 14—Sadat says the raid against Israel was "irresponsible," "sad," and "tragic."

Israeli troops invade southern Lebanon to destroy terrorist installations there.

Mar. 15—The U.S. says Israel's attack on Lebanon has placed obstacles in the way of peace negotiations.

Begin says Israeli troops will remain in Lebanon until a peace agreement is reached that will guarantee Israel's borders.

Egypt's Foreign Minister condemns Israel's attack on Lebanon.

The U.S.S.R. condemns the Israeli attack on Lebanon.

Mar. 16—Sadat repeats his desire to reach an agreement with Israel but warns that Israel must withdraw from Lebanon.

The U.S. says it expects Israel to retreat from Lebanon and expresses hope that an international peace-keeping force will replace the Israelis there.

Mar. 17—The Israeli forces move deeper into Lebanon.

Mar. 18—Syrian President Hafez al-Assad says Syria's

borders and sky are open to all Arabs who want to move through Syria to fight against Israel.

Mar. 19—It is reported from Tel Aviv that Israeli troops control almost all Lebanon south of the Litani River.

Begin arrives in Washington, D.C., to confer with President Carter.

Mar. 21—The Israeli government orders a cease-fire in southern Lebanon.

Mar. 22—The first members of a U.N. peace-keeping force enter southern Lebanon.

Mar. 24—Syria and Lebanon announce they will not provide arms to Palestinian guerrillas in southern Lebanon.

Begin returns to Israel; no agreement was reached with President Carter.

Mar. 28—Begin urges Sadat to resume discussions with Israel.

Mar. 30—Israeli Defense Minister Ezer Weizman arrives in Cairo to meet with President Sadat.

Mar. 31—The Palestine Liberation Organization (PLO) forces observe a cease-fire in southern Lebanon.

Weizman returns to Jerusalem; no report on his talks with Sadat is issued.

Apr. 6—Israel informs the U.N. it will begin a 2-stage troop withdrawal from Lebanon April 11.

North Atlantic Treaty Organization (NATO)

Apr. 19—In Frederikshavn, Denmark, NATO's Nuclear Planning Group promises to keep open the option of using a neutron warhead if the U.S. produces that weapon and says it will promote modernization of tactical nuclear weapons in Europe.

United Nations

(See also *Lebanon; Namibia; U.S.S.R.*)

Mar. 6—African nations at the U.N. ask the Security Council to condemn the Salisbury agreement reached by Rhodesian black and white leaders.

Mar. 13—The U.S. Food and Agriculture Organization reports from Rome that because of the inefficient distribution of food the number of hungry people in the world has increased nearly 14 percent since 1970.

Mar. 17—Lebanon asks the Security Council to ask Israel to withdraw from Lebanese territory.

Mar. 18—The U.S. asks the Security Council to call for Israeli troop withdrawal from Lebanon and to set up a U.N. peace-keeping force there.

Mar. 19—The Security Council asks Israel to withdraw her forces from southern Lebanon and acts to set up a 4,000-man peace-keeping force to take over the border area.

Mar. 23—A six-week conference of 68 wheat-exporting and wheat-importing nations adjourns; it will resume meetings later in 1978.

Mar. 29—A Swedish soldier in the U.N. peace-keeping force in Lebanon is killed in a land mine explosion; a 2d man is injured.

Apr. 12—The U.S.S.R. is reportedly asking the U.N. to dismiss Under Secretary General Arkady N. Shevchenko, a Soviet citizen, who has refused a summons to return to Moscow because of political differences with his government.

AFGHANISTAN

Apr. 27—Afghanistan radio reports a coup d'état by military insurgents. The government of President Mohammad Daud is replaced by a military revolutionary council headed by Lieutenant General Abdul Khadir.

Apr. 28—It is reported in New Delhi that former President Mohammad Daud was killed in the coup; fighting continues in Kabul between rival military groups.

Apr. 29—Afghan radio confirms the deaths of President Mohammad Daud, his brother and 4 other high-ranking government officials.

It is reported that fighting in Kabul has ended.

Apr. 30—The military junta names a civilian, Nur Mohammad Tarakki, as President of the Revolutionary Council. The Soviet Union officially recognizes the new regime.

ARGENTINA

Mar. 29—President Jorge Rafael Videla announces that the military members of the ruling junta will be replaced by civilians this year.

Apr. 11—Under Secretary for Economic Coordination Miguel Tobias Padilla is assassinated by left-wing terrorists.

Apr. 17—The editor of *La Opinion*, Jacobo Timerman, is released from prison. He was held for more than a year without trial.

Apr. 22—In a growing dispute among the members of the military junta over the next President, the army high command announces its support of President Jorge Rafael Videla.

Apr. 26—The ruling military junta rejects the April 23 offer of the outlawed Radical party to join in a "dialogue" with the government to work out a plan to return to a democratic system. Interior Minister General Albano Harguindeguy rules out any conversation with outlawed political parties.

Apr. 30—General Videla receives the support of all 3 leaders of the country's armed forces for a 2d term as President.

BANGLADESH

Apr. 30—It is reported in Dacca that nearly 70,000 Burmese Muslims have fled to Bangladesh in the last few weeks despite Bangladesh's attempt to seal the border.

BELGIUM

(See *Intl, Intl Terrorism*)

BOLIVIA

Mar. 17—In a continuing dispute over access to the Pacific Ocean, Bolivia breaks diplomatic relations with Chile.

BRAZIL

(See *U.S., Foreign Policy*)

BURMA

Mar. 2—In Rangoon, the People's Congress reelects President Ne Win to a 2d 4-year term as chairman of the Council of State.

CAMBODIA

Apr. 21—In Washington, D.C., U.S. President Jimmy Carter says the Cambodian government is the "worst violator of human rights in the world today."

CHAD

Apr. 20—At the request of the Chad government, France sends 200 Foreign Legionnaires to Chad, in the wake of the deaths of 2 French military advisers April 15. The

advisers died during a guerrilla attack by the Chad National Liberation Front, which has recently intensified its efforts against the government.

CHILE

(See also *Bolivia; U.S., Administration*)

- Mar. 21—General Manuel Contreras Sepulveda resigns as commander of the army; he was a close adviser of President Augusto Pinochet's and head of the secret police (Dina) when Orlando Letelier, an exiled opposition leader, was assassinated in Washington, D.C., in 1976. The U.S. State Department suspects that 2 members of the Chilean secret police were involved in the murder of Letelier, and has asked that they be questioned by the Chilean government.
- Apr. 1—In Santiago, Air Force General Gustavo Leigh Guzman announces the end of the curfew that has been in effect since September, 1973, when the military took control.
- Apr. 5—President Pinochet announces that all political prisoners will either be pardoned or have their sentences commuted to exile.
- Apr. 8—Following pressure from the U.S., the military government deports Michael Vernon Townley, a U.S. electronics expert who has lived in Chile for 20 years. Townley, suspected of being involved in the assassination of Letelier, is a former member of Dina, the Chilean secret police, and former adviser to President Pinochet.
- Apr. 19—President Pinochet declares a general amnesty for people arrested between September 11, 1973, and March 10, 1978, for violation of the state-of-siege laws.
- Apr. 26—In Washington, D.C., the U.S. government charges Michael Townley with conspiring to murder former Chilean Ambassador Letelier.

CHINA

- Mar. 1—Deputy Chairman of the Communist party Yeh Chien-ying submits the draft of a new constitution to the National People's Congress, which began meeting in Peking on February 26.
- Mar. 5—The National People's Congress reelects Chairman of the Communist party Hua Kuo-feng as Prime Minister; Yeh is elected chairman of the Congress's Standing Committee.
- The National People's Congress approves a new constitution.
- Mar. 6—Prime Minister Hua Kuo-feng announces that revolutionary management committees for provincial level schools, factories and farm brigades will be abolished.
- Mar. 16—Deputy Prime Minister Li Hsien-nien concludes a 4-day visit to Manila.
- Mar. 26—In Peking, officials confirm that the government has rejected a recent Soviet proposal to improve relations between the 2 countries.
- Apr. 10—U.S. Department of Agriculture officials report that private U.S. exporters have entered into sales agreements with the Chinese government for the sale of 22 million bushels of wheat, to be delivered during the 1978-1979 marketing year. This is the first Chinese grain purchase from the U.S. since 1974.
- Apr. 13—In Tokyo, the Japanese Foreign Ministry reports that 32 Chinese fishing boats, armed with machine guns, have taken up positions in the waters around the Senkaku Islands, 250 miles southwest of Okinawa, and refuse to leave. 60 additional Chinese vessels are in the waters beyond the 12-mile limit.

Apr. 15—Deputy Prime Minister Keng Piao claims the presence of Chinese boats off Senkaku Islands was "accidental."

Apr. 30—In a reversal of Maoist policy, Deputy Prime Minister Teng Hsiao-ping calls on schools, factories and offices to "recruit only those who are outstanding"; he stresses the primary responsibility of students to study.

CUBA

(See *Ethiopia*)

CYPRUS

(See also *Greece*)

- Apr. 4—In Nicosia, a 3-member tribunal convicts Samir Mohammed Khadar and Zayed Hussein al-Ali, both Palestinians, of the murder of Yousef el-Sebai, editor of the Egyptian newspaper *Al Ahram*, who was murdered in Cyprus February 18. They are sentenced to die on June 1.
- Apr. 13—In Vienna, Turkish Cypriot delegates inform U.N. Secretary General Kurt Waldheim that they are prepared to discuss territorial questions with Greek Cypriots.
- Apr. 19—Cypriot President Spyros Kyprianou rejects a Turkish Cypriot proposal to settle the territorial dispute on Cyprus.

EGYPT

(See also *Intl, Middle East*)

- Mar. 1—U.S. government sources in Washington, D.C., report that Egypt has ordered 46 Mirage F-1 jets from France.
- Mar. 25—A government spokesman announces the government's decision to continue with its peace initiative in the Middle East despite the recent Israeli attack in southern Lebanon.

ETHIOPIA

- Mar. 8—In a radio broadcast in Mogadishu, a spokesman for the Western Somali Liberation Front says that Somali forces have withdrawn from the Ogaden region of Ethiopia after artillery, plane, and infantry attacks by Soviet-supported Ethiopian forces.
- Mar. 9—In Washington, D.C., U.S. President Jimmy Carter announces that Soviet and Cuban troops will leave the Ogaden region as soon as Ethiopian troops have reestablished control over the region. The Soviet government has agreed that neutral international observers may be sent to the area to insure that reprisals against Somalis are not taken by Ethiopian troops.
- Mar. 11—In Nairobi, the Ethiopian Ambassador to Kenya demands that Somalia pay Ethiopia compensation for damages caused by the recent fighting in the Ogaden.
- Apr. 25—The Eritrean Liberation Front and the Eritrean People's Liberation Front agree to merge their forces to fight for the area's independence from Ethiopia.
- Apr. 26—Aided by Cuban fighter pilots, government forces attack rebel strongholds in Eritrea; this is the 2d major attack since Somali forces withdrew from the Ogaden in southeastern Ethiopia.

FRANCE

(See also *Chad; Egypt*)

- Mar. 12—Preliminary nationwide legislative elections are held.
- Mar. 13—Election returns give the left-wing opposition parties 45.1 percent of the vote and the center-right

coalition that supports President Valéry Giscard d'Estaing 46.5 percent of the 29 million votes cast. Splinter groups win 3.3 percent. The political polls predicted that the left would win an easy majority of the votes.

Mar. 16—*Amoco Cadiz*, a tanker carrying 230,000 tons of oil, breaks up off the coast of Brittany, causing an enormous oil spill.

Mar. 19—The final election is held for seats in the National Assembly.

Mar. 20—Election returns give the government center-right coalition 291 seats in the Assembly; the leftist parties win 200 seats.

Mar. 22—President Giscard announces that 600 French soldiers will be sent to Lebanon as part of a United Nations peace-keeping operation.

Mar. 31—President Giscard reappoints Raymond Barre as Prime Minister.

Apr. 3—The National Assembly elects as its president Jacques Chaban-Delmas, whose candidacy was supported by President Valéry Giscard d'Estaing.

Apr. 5—Prime Minister Raymond Barre announces the membership of his new Cabinet; most of those who served in the previous Cabinet have been retained.

Apr. 19—A Defense Ministry spokesman refuses either to confirm or deny reports in a *France-Soir* article that the government has exploded a neutron bomb in the South Pacific.

GERMANY, WEST

(See also U.S., *Foreign Policy*)

Apr. 13—In Bonn, U.S. Secretary of Defense Harold Brown assures Chancellor Helmut Schmidt and Defense Minister Hans Apel that the U.S. decision to delay production of the neutron bomb does not weaken the military position of NATO.

GHANA

Mar. 8—Ghana's ambassador to Switzerland and Austria Kenneth Dadzie is chosen by U.N. Secretary General Kurt Waldheim to serve as U.N. Director General for Economic Development, the 2d highest ranking post in the U.N.

Mar. 30—A national referendum is held to approve the form of government that will replace the military government in power since 1972.

Mar. 31—Early election returns indicate that voters favor maintaining the current single-party form of government.

Apr. 4—Following last month's referendum results, the government bans 3 national political parties.

Apr. 16—In Accra, it is announced that on April 5 the government ordered the arrest of 17 prominent civilian politicians.

GREECE

Mar. 10—In Montreux, Switzerland, talks begin between Greek Prime Minister Constantine Caramanlis and Turkish Prime Minister Bulent Ecevit on the Aegean Sea and Cyprus.

Mar. 17—In Athens, Prime Minister Caramanlis tells Parliament that no commitments were made by either side in the recent talks on Cyprus and the Aegean.

Apr. 2—Defense Minister Evangelos Averoff-Tositsas criticizes the recent proposal made by U.S. President Jimmy Carter to Congress to end the ban on the sale of weapons to Turkey.

GUATEMALA

Mar. 5—National presidential elections are held. The outgoing President, General Kjell Laugerud Garcia, is prohibited by law from succeeding himself.

Mar. 13—Because no candidate won a majority in the March 5 elections, the 61-member Congress holds runoff elections. Government-backed candidate Romeo Lucas Garcia receives the unanimous support of the 35 members who take part in the voting; 26 members abstained.

HUNGARY

Mar. 3—In Washington, D.C., U.S. President Jimmy Carter initials a trade agreement with Hungary giving Hungary most-favored-nation status in exchange for Hungary's maintaining emigration practices that are acceptable to the U.S.

INDIA

(See also U.S., *Foreign Policy*)

Mar. 6—At the conclusion of a 6-day meeting of the Indo-Soviet Commission on Economic, Scientific and Technical Cooperation, Foreign Minister Atal Bihari Vajpayee initials an agreement calling for an increase in trade and joint ventures between the 2 countries.

Apr. 17—In New Delhi, Prime Minister Morarji R. Desai tells Parliament that with the full knowledge of the Indian government a joint Indian-U.S. intelligence team planted a nuclear-powered spy device in the Himalayan Mountains 12 years ago. Reports of the mission first appeared in a U.S. publication, *Outside*, earlier this month.

Apr. 24—Prime Minister Morarji R. Desai criticizes the April 20 decision of the U.S. Nuclear Regulatory Agency to suspend shipments of enriched uranium fuel for the U.S.-built atomic power plant near Bombay.

INDONESIA

Mar. 11—President Suharto addresses the opening session of the Indonesia's People's Consultative Assembly, which is being held to elect a President. Suharto is the only candidate.

Mar. 22—The Congress unanimously reelects Suharto as President for a 3d 5-year term and elects former Foreign Minister Adam Malik as Vice President.

Mar. 30—President Suharto announces the members of his new Cabinet; 5 more military men are appointed to the Cabinet.

Apr. 11—In a joint interview, the Internal Security and Military Security chiefs report that by the end of 1979 most of the 20,000 political prisoners will be released; between 200 and 300 political prisoners will remain in detention.

IRAN

Mar. 7—It is reported that Shah Mohammed Riza Pahlevi has ordered an investigation into the activities of the Tabriz branch of Savak, the National Intelligence and Security Organization, following rioting in Tabriz last month.

Mar. 31—Police are called in to put down violence in a number of cities after a general strike yesterday called by the underground political opposition.

ISRAEL

(See also Intl, *Middle East; Lebanon*)

Mar. 7—In Washington, D.C., Israeli Defense Minister Ezer Weizman arrives for talks with U.S. President Jimmy Carter, Defense Secretary Harold Brown and Secretary of State Cyrus Vance.

Mar. 11—In a 40-mile rampage along the Tel Aviv-Haifa highway, Arab terrorists seize a bus and take its passengers hostage. The rampage ends in fighting with police outside Tel Aviv. 37 Israelis are killed and 76 are wounded; all the Arab terrorists are reported killed.

Mar. 15—In retaliation for the Arab guerrilla raid, Israeli forces attack Palestinian camps in southern Lebanon.

Mar. 24—Prime Minister Menahem Begin returns from Washington, D.C.

Mar. 26—The Cabinet votes unanimously to support Prime Minister Begin's proposals for a Middle East settlement.

Mar. 29—Israel begins oil production in former Egyptian territory in the Gulf of Suez.

Apr. 2—Defense Minister Ezer Weizman informs the Cabinet that his talks in Cairo last week failed to persuade the joint Israeli and Egyptian Political and Military Committees to resume negotiations.

Damascus radio carries a broadcast in which the Syrian government accuses Israel of violating the disengagement agreement in the Golan Heights; the report follows the death of 12 Syrian soldiers and civilians in a mine explosion.

Apr. 3—In Bucharest, Foreign Minister Moshe Dayan meets with Romanian President Nicolae Ceausescu for talks on Israel's negotiating position in the Middle East.

Apr. 6—The government announces a 2-stage plan for the withdrawal of troops from southern Lebanon, beginning April 11.

Apr. 7—In Washington, D.C., the U.S. State Department says that Israel violated an unpublicized agreement when she exploded cluster bombs provided by the U.S. in Lebanon last month.

Apr. 16—The Cabinet issues a statement reaffirming its belief that U.N. Security Council Resolution 242 is the basis for Israeli-Arab peace negotiations.

Apr. 30—In Washington, D.C., Prime Minister Begin arrives for talks with President Carter and Secretary of State Vance.

ITALY

Mar. 8—Prime Minister-designate Giulio Andreotti, the Communist party and 3 minor parties agree in principle on the outline of a new economic and social program to be carried out by the Andreotti government.

Mar. 9—In Turin, 15 leaders of the Red Brigades, an urban terrorist group, go on trial for committing acts of violence against the state 2 years ago.

Mar. 10—In Turin, Rosario Berardi, a police official, is shot and killed.

Mar. 13—In Rome, President Giovanni Leone swears in the new Cabinet of Prime Minister Andreotti, which is made up entirely of Christian Democrats.

Mar. 16—In Rome, former Prime Minister Aldo Moro is kidnapped and his 5 bodyguards are killed; the Red Guards claim responsibility for the kidnapping and murders; they are demanding the release of the brigade leaders on trial in Turin in exchange for Moro's release.

Mar. 29—Interior Minister Francesco Cossiga receives a handwritten note from Moro who says he fears he will reveal state secrets if the government does not soon meet his kidnappers' demands.

Apr. 2—In Rome, Pope Paul VI appeals to the kidnappers to release former Prime Minister Moro.

Apr. 11—In Turin, terrorists shoot and kill a police officer; one of the terrorists, who is suspected of being a member of the Red Guards, is wounded and taken prisoner.

Apr. 14—The Chamber of Deputies votes 308 to 275 to permit a woman over 18 years of age to obtain free, state-subsidized abortions during the first 90 days of pregnancy; the bill goes to the Senate.

Apr. 15—In a statement distributed in 4 major cities, Red Guard terrorists claim they have completed the interrogation of Moro, have found him guilty, and have sentenced him to death.

Apr. 18—Following an announcement by the Red Guards that Moro has been executed, Italian security forces search unsuccessfully for his body in Lake Duchessa, the area designated as the burial spot.

Apr. 20—The Red Brigades distribute a photograph of Moro that purports to prove he is still alive; they give the authorities 48 hours to release an unspecified number of "Communist prisoners" in exchange for Moro's release.

Apr. 23—For the 2d time in 2 days, Pope Paul issues an appeal to the kidnappers to release Moro.

Apr. 24—The Red Brigade issues a list of 13 prisoners they wish released in exchange for the release of Moro.

Apr. 26—In a suburb of Rome, Red Brigade terrorists shoot and wound Christian Democrat Girolama Mechelli.

Apr. 27—In Turin, Red Brigade terrorists shoot and wound Fiat Motor Company executive Sergio Palmieri.

JAPAN

(See also *China*)

Mar. 28—After 2 days of fighting between police and demonstrators who attacked the new international airport outside Tokyo, the Cabinet votes to postpone until May the opening of the controversial facility.

Despite the extraordinary purchase by the Bank of Japan of more than 1 billion U.S. dollars, the U.S. dollar falls to a postwar low against the yen.

Apr. 15—Following an announcement that the trade surplus for March reached a record high of \$2.45 billion, the Ministry of International Trade and Industry asks exporters to curb their shipments.

Apr. 25—After a 5-year legal battle, a district court rules that the government has the authority to construct nuclear power plants for peaceful purposes.

KENYA

(See *U.S., Foreign Policy*)

KOREA, SOUTH

(See also *U.S., Foreign Policy; Political Scandal*)

Apr. 2—In Washington, D.C., former U.S. Ambassador to South Korea William J. Porter admits that U.S. intelligence agents placed a listening device in the office of Korean President Park Chung Hee in Seoul in the 1960's.

Apr. 6—U.S. Ambassador Richard L. Sneider tells Korean officials that the U.S. government knows nothing about the alleged eavesdropping.

Apr. 20—A South Korean airliner carrying 97 passengers and a crew of 16 is forced down over Soviet territory by a Soviet plane; two people are killed.

Apr. 21—In Moscow, the government asks a U.S. civilian airline to rescue the survivors of the crash.

Apr. 29—In Leningrad, the pilot and navigator of the downed Korean passenger plane are pardoned by Soviet officials for accidentally violating Soviet airspace.

LEBANON(See also *Intl. Middle East, U.N.*)

- Mar. 14—Israeli planes begin an aerial bombardment of Palestinian bases in southern Lebanon.
- Mar. 18—Thousands of refugees, Palestinians and Lebanese alike, flee the area of southern Lebanon still under attack by Israeli artillery, planes and gunboats.
- Mar. 30—U.N. peace-keeping troops establish positions between Palestinian guerrillas and Israeli forces in southern Lebanon.
- Apr. 8—Prime Minister Selim al-Hoss demands the immediate Israeli withdrawal of troops from Lebanon.
- Apr. 9—The government announces plans to assist the refugees to return home on Apr. 11, the day the Israeli troop withdrawal is scheduled to begin.
- Apr. 11—Israeli troops begin a partial withdrawal from southern Lebanon.
- Apr. 13—Following 5 days of fighting in Beirut, Syrian peace-keeping troops and Lebanese Christian rightists announce a cease-fire; more than 100 people have been reported killed in the fighting.
- Apr. 14—Israeli troops complete the 2d stage of their 2-stage withdrawal from southern Lebanon.
- It is reported that 2,500 of the 4,000 peace-keeping soldiers under the auspices of the U.N. Security Council have taken up positions in the area.
- Apr. 19—The "nonpolitical" Cabinet of Prime Minister Selim al-Hoss submits its resignation to President Elias Sarkis; Sarkis accepts the resignation but asks the Cabinet members to stay on until a new Cabinet can be formed.
- Apr. 23—In Beirut, a 13-member parliamentary committee, comprised of Muslim and Christian leaders, agrees to prohibit any armed forces in the country except the country's legal forces.
- Apr. 25—The Palestine Liberation Organization says it will not agree to disarm its guerrilla forces.
- Apr. 27—Parliament votes to prohibit all rival militia forces and all Palestinian guerrilla activity.
- Apr. 28—President Sarkis asks Prime Minister Hoss to form a new government.

LIBERIA(See *U.S., Foreign Policy*)**MALI**

- Mar. 9—Foreign Minister Charles Sissoko is arrested on charges of high treason.

MEXICO

- Mar. 21—Under Secretary of Education and former Communications Minister Eugenio Méndez Docurro is arrested and charged with corruption.

MOZAMBIQUE

- Apr. 23—The Mozambique Information Agency reports that President Samora Machel has reshuffled his Cabinet; this is the 1st Cabinet change since the country gained independence in 1975.

NAMIBIA (South-West Africa)

- Mar. 27—In Katutura township, Herero tribal leader Chief Clemens Kapuuo is assassinated by unidentified gunmen.
- Mar. 30—The U.S., Britain, France, West Germany, and Canada submit a proposal for black majority rule in

Namibia to U.N. Secretary General Kurt Waldheim.

- Apr. 24—In the United Nations, members of a special General Assembly session demand that South Africa withdraw from Namibia immediately.
- Apr. 25—In Cape Town, South African Prime Minister John Vorster announces his government's decision to accept the Western proposals for independence for Namibia by the end of 1978.
- Apr. 27—In Washington, D.C., Sam Nujoma, leader of the South-West African People's Organization, meets with U.S. Secretary of State Cyrus Vance; Nujoma urges substantial amendments to the recent Western proposals for the independence of Namibia.

NETHERLANDS

- Mar. 4—Defense Minister Roelof Kruisinga resigns after the Cabinet's refusal to denounce the use of the neutron bomb. Christian Democrat Willem Scholten is named to replace Kruisinga.
- Mar. 8—Parliament adopts a resolution opposing production of the neutron bomb.

NICARAGUA

- Mar. 8—In Managua, General Reynaldo Perez Vega, the chief military aide to President Anastasio Somoza Debayle, is kidnapped and murdered by members of the Sandinist National Liberation Front.

NIGERIA

- Mar. 31—In Lagos, U.S. President Jimmy Carter arrives for an official state visit, the first visit by an American President to sub-Saharan Africa.

PAKISTAN

- Mar. 18—In Lahore, former Prime Minister Zulfikar Ali Bhutto is found guilty of conspiring to murder a political opponent and is sentenced to death.
- Mar. 25—Former Prime Minister Bhutto files an appeal of his conviction and sentence with the Supreme Court.

PANAMA(See also *U.S., Legislation*)

- Apr. 7—After the vote in the U.S. Senate on March 16 on the 1st Panama Canal Treaty including a reservation to the treaty, Brigadier General Omar Torrijos sends a letter to 115 heads of state and a copy of the controversial reservation; he expresses concern over the reservation, which gives the U.S. the right to intervene militarily to keep the canal open after Panama takes over its operation in the year 2000.
- Apr. 18—The U.S. Senate approves the 2d Panama Canal treaty that deals with the procedure for turning the canal over to Panamanians. A reservation is attached to the 2d treaty in effect nullifying the controversial reservation to the first treaty.

Government opposition leaders call for a new plebiscite on the canal treaties.

PHILIPPINES

- Mar. 3—President Ferdinand E. Marcos promises to relinquish his law-making powers to the interim National Assembly, which will be elected April 7.
- Mar. 10—From his jail cell, presidential opposition candidate Benigno S. Aquino, Jr., appears on television to rebut government charges that he was an employee of the U.S. Central Intelligence Agency.

Apr. 7—National elections are held for members of an interim National Assembly; these are the first elections since President Ferdinand E. Marcos imposed martial law in September, 1972. Marcos is not a candidate for office; a seat in the 200-member assembly has been automatically reserved for him.

Apr. 9—The Commission on Elections reports that only 15 percent of the votes in Manila have been tabulated; 21 seats in the assembly were being contested.

In Manila, 6 leaders of the opposition party, the People's Force party, and 600 of its members are arrested and charged with violating the law on political demonstrations because they marched through Manila to protest the election.

Apr. 11—With only 20 percent of the Manila votes counted, the Commission shows Ismelda Marcos's New Society Movement winning 366,488 votes and the opposition party of former Senator Benigno S. Aquino, Jr., winning 257,000. The opposition party has accused the government of fraudulent voting and harassment.

RHODESIA

Mar. 2—In Salisbury, Prime Minister Ian D. Smith and black nationalist leaders Bishop Abel Muzorewa, the Reverend Ndabaningi Sithole and Senator Jeremiah Chirau announce agreement on the procedure for the transfer of power to black majority rule by the end of 1978.

Mar. 3—In Salisbury, Prime Minister Smith and the 3 black nationalists sign the agreement for the transfer to black rule.

Members of the Patriotic Front, an alliance of black nationalist insurgents, denounce the agreement as a "sell-out."

Mar. 7—In a "self-defense operation," the government acknowledges that its troops crossed into Zambia and killed 38 black guerrillas belonging to the army of exiled leader Joshua Nkomo.

Mar. 8—In Washington, D.C., U.S. Secretary of State Cyrus R. Vance meets with British Foreign Secretary David Owen. Before his meeting with Owen, Vance meets with Rhodesian black nationalist leader and signer of the Salisbury agreement Bishop Abel Muzorewa.

In the U.N., black Rhodesian guerrilla leaders Robert Mugabe and Joshua Nkomo say they will not sign the agreement on the transition to black rule in Rhodesia worked out in Salisbury. They claim the Salisbury agreement will perpetuate white minority control.

Mar. 14—In the U.N., the Security Council approves a resolution calling the recent settlement between the Smith government and 3 black nationalists "illegal and unacceptable."

Mar. 17—In Pretoria, South Africa, British and U.S. officials meet with Rhodesian officials in an effort to persuade the Rhodesian government to reopen negotiations for an internationally acceptable plan for the transfer to black rule. Britain and the U.S. are calling for the representation of black nationalist guerrillas in the transition government.

Mar. 21—In Salisbury, Bishop Muzorewa, the Reverend Sithole, and Senator Chirau are sworn in as members of the provisional government that is to prepare for a black government by December, 1978.

Mar. 26—In Dar es Salaam, Tanzania, Presidents of the frontline states, Tanzania, Zambia, Botswana and Mozambique, and leaders of the guerrilla groups in Zambia and Mozambique condemn the settlement reached in Rhodesia.

Apr. 5—The 4-member Executive Council announces the composition of a new Cabinet: the United African National Council will hold the posts of justice, finance, and transport; the African National Council, the ministries of defense, foreign affairs, and agriculture; and the Zimbabwe United People's Organization, the ministries of internal affairs, education, and water development.

Apr. 10—The interim government rejects a new proposal made by U.S. Ambassador to Zambia Stephen Low and British Foreign Office representative John Graham for a joint conference including guerrilla leaders.

Apr. 12—Prime Minister Ian Smith announces the names of 9 white Cabinet ministers who will serve in the Cabinet with 9 black nationalist ministers.

Apr. 13—The government releases more than 100 black political prisoners, some of whom have been held without trial for more than 10 years.

In Dar es Salaam, U.S. Secretary of State Cyrus Vance receives assurances that black nationalist guerrilla leaders will agree to a conference on Rhodesia including all parties.

Apr. 14—In Dar es Salaam, Secretary Vance and Foreign Minister David Owen meet with black nationalist leaders Joshua Nkomo and Robert M. Mugabe.

In Salisbury, the new 18-member Cabinet is sworn in.

Apr. 16—In Pretoria, South Africa, Vance and Owen meet with South African Foreign Minister Roelof F. Botha. Botha stresses his government's desire for a peaceful settlement between the Patriotic Front and the new government of Rhodesia.

Apr. 17—In Salisbury, Vance and Owen meet with Prime Minister Smith and the 3 black Rhodesian leaders.

Apr. 25—The transition government refuses to join in a meeting with the guerrilla leaders of the Rhodesian Patriotic Front.

Apr. 28—Following his critical remarks about the white-dominated judiciary and police, black Justice Minister Byron R. Hove is dismissed from his post by the Executive Council.

Bishop Abel Muzorewa, a member of the Council, denies that he knew of the Council's decision.

Apr. 29—In Johannesburg, dismissed black Justice Minister Byron Hove says that the recent agreement on a transition government helps Prime Minister Smith to "cheat" blacks of any real power.

Apr. 30—Bishop Abel Muzorewa demands that Hove be reinstated as Justice Minister; he threatens to withdraw from the transition government if Hove is permanently dismissed.

ROMANIA

(See U.S., *Foreign Policy*)

SEYCHELLES

Apr. 29—A government spokesman reports that former President James Mancham and 3 former Cabinet ministers have been arrested for plotting to overthrow the government.

SOMALIA

(See also *Intl. Arab League; Ethiopia*)

Mar. 18—In Mogadishu, a U.S. State Department delegation headed by Richard M. Moose, Assistant Secretary of State for African Affairs, arrives for talks with Somali President Mohammed Siad Barre on U.S. economic and military assistance.

Apr. 9—The government reports an unsuccessful coup

d'état by army officers who were influenced by "foreign powers."

Apr. 12—President Mohammed Siad Barre reports that 20 people were killed and 34 wounded in the recent coup attempt.

Apr. 15—Sporadic fighting continues in the Ogaden section of Ethiopia; Somali guerrillas claim to have killed more than 1,000 Ethiopian and Cuban soldiers in recent fighting there.

SOUTH AFRICA

(See also *Namibia*)

Mar. 10—Citibank, the 2d largest bank in the U.S., announces that it will not extend loans to the South African government or government-owned manufacturing or utility companies because of the government's apartheid policy.

In Johannesburg, Justice Minister James T. Kruger announces the release of 10 black agitators arrested in the anti-government demonstrations last year. Percy Qoboza, editor of *The Weekend World*, is one of the 10.

Apr. 7—In Pretoria, 6 black nationalists found guilty yesterday of conspiring to overthrow the government are sentenced to prison terms ranging from 7 to 18 years; 6 other black nationalists were found not guilty.

Apr. 10—In the Transkei, Prime Minister Chief Kaiser Matanzima breaks diplomatic relations with the South African government, the only government that officially recognizes its existence. South Africa has refused to cede the disputed East Griqualand area to Transkei.

SPAIN

Apr. 19—In Madrid, Secretary General of the Spanish Communist party Santiago Carrillo addresses the opening session of the party's first congress in 46 years.

Apr. 21—The Communist party votes to delete the word "Leninist" from its party statutes.

Apr. 27—Parliament votes to lift a 40-year prohibition on the sale of contraceptives.

SYRIA

(See also *Intl, Middle East*)

Mar. 27—Prime Minister Major General Abdel Rahman Khlaifawi submits his resignation; President Hafez al-Assad appoints Mohammed Ali al-Halabi, Speaker of the Parliament, as the new Prime Minister. President Assad appoints Major General Sobhi Haddad to replace Major General Naji Jamil as commander of the air force.

Mar. 30—Prime Minister Halabi announces the members of his new Cabinet. Most of the Cabinet members served in the previous Cabinet.

TAIWAN

Mar. 21—The National Assembly elects Prime Minister Chiang Ching-kuo, son of Chiang Kai-shek, as President.

TURKEY

(See *Intl, CENTO; Cyprus; Greece*)

U.S.S.R.

(See also *Intl, Arms Control; China; India; South Korea; U.S. Foreign Policy*)

Mar. 1—Chairman of the State Committee on Prices Nikolai T. Glushkov announces price increases for coffee and gasoline; a gallon of gasoline will cost \$.83 and a pound of coffee will cost \$12.73.

Mar. 3—Soyuz 28, with a Russian and a Czechoslovak on board, docks with the orbiting Salut 6 space station.

Mar. 16—Soyuz 27 returns to earth with 2 Soviet astronauts; the astronauts spent a record 96 days orbiting the earth.

Mar. 17—An article in Tass, the official press agency, criticizes U.S. President Jimmy Carter's speech of March 17 on defense policies. The article accuses the U.S. of increasing tensions between the U.S. and the Soviet Union.

Mar. 28—Soviet specialist on U.S. affairs Georgi A. Arbatov says that relations between the U.S. and U.S.S.R. will deteriorate if the U.S. does not sign a strategic arms limitation treaty with the Soviet Union.

In Moscow, it is announced that the volume of trade between the U.S. and U.S.S.R. declined by 26.5 percent in 1977.

Apr. 8—Tass, the official Soviet press agency, says that U.S. President Jimmy Carter's recent decision to postpone production of the neutron bomb does "not represent a significant renunciation of the neutron weapon."

Apr. 9—President Leonid I. Brezhnev returns to Moscow from a 13-day tour along the Soviet-Chinese border.

Apr. 10—In Washington, D.C., the U.S. State Department reports that top-ranking Soviet official in the U.N. Secretariat Arkady N. Shevchenko has defected from the U.S.S.R. but has not requested political asylum in the U.S.

The government publishes official statistics that show its trade deficit for 1977 with the West at \$1.59 billion.

Apr. 17—The Georgian Soviet Republic reinstates Georgian as the official state language.

Apr. 18—In New York, retired General and prominent Soviet dissident Pyotr G. Grigorenko asks for political asylum in the U.S.

The Armenian Soviet Republic reinstates Armenian as the official state language.

Apr. 20—In Moscow, U.S. Secretary of State Cyrus Vance meets with Foreign Minister Andrei A. Gromyko.

Grigorenko is granted political asylum by the U.S.

Apr. 24—The Azerbaijan Soviet Republic reinstitutes Azerbaijani as its official state language.

In Moscow, following a visit by Cuban Foreign Minister Isidoro Malmierca Peoli, a joint communiqué is issued pledging continued support to black nationalist guerrillas in southern Africa.

Apr. 26—Soviet Deputy Foreign Minister Leonid F. Ilyichev arrives in Peking to resume border negotiations that broke off in 1977.

In the United Nations, Shevchenko resigns his post with the U.N. and announces that he will remain in the U.S.

Apr. 28—In the United Nations, Mikhail D. Sytenko is nominated to replace Shevchenko as Under Secretary General; Shevchenko refused to return to Moscow earlier this month and has since resigned his post.

UNITED KINGDOM

Great Britain

(See also *Rhodesia; U.S. Foreign Policy; Yugoslavia*)

Mar. 6—After pressure from the U.S. government and national protesters, the government decides to submit to Parliament a proposal to construct a nuclear fuel reprocessing plant in northwestern England.

Mar. 14—The government announces a trade surplus of \$350 million for the month of February.

Mar. 21—A bipartisan Select Committee of the House of Commons recommends that immigration of all Asians and Africans to England be stopped and that closer surveillance on Asians and Africans already in England be instituted.

The government submits to Parliament a plan for using the revenues from the North Sea oil; the plan calls for investing the revenues in industry, cutting personal taxes and developing new energy resources.

Apr. 5—In London, Foreign Secretary David Owen says that Soviet policy in the Horn of Africa has placed "a large question mark over the future of détente." He estimates there are 36,000 Cuban troops and 1,000 Soviet military advisers in Africa.

Apr. 11—Chancellor of the Exchequer Denis Healey submits the government's budget to Parliament. The budget calls for substantial tax cuts and a small increase in spending.

Apr. 14—The government reports a trade deficit of \$305 million for the month of March.

UNITED STATES

Administration

Mar. 1—The Postal Services board of governors selects William Bolger as Postmaster General to succeed Benjamin Bailar.

Mar. 2—Secretary of the Treasury W. Michael Blumenthal gives Congress President Jimmy Carter's "very reasonable and very adequate" plan to provide federal guarantees over a 15-year period for up to \$2 billion in long-term bonds to help improve New York City's financial picture.

At a Washington, D.C., news conference President Carter outlines his plan to reorganize the Civil Service System to reward merit and eliminate incompetents; the plan has been sent to Congress.

Mar. 8—Former board chairman of Textron, Inc., G. William Miller becomes chairman of the Federal Reserve Board, succeeding Arthur Burns.

Mar. 16—The Treasury Department proposes new regulations to monitor the sale of handguns, shotguns and rifles.

Mar. 20—The Justice Department charges 2 International Telephone and Telegraph Corporation officials, Edward Garrity and Robert Berrelez, with 12 felony offenses; the charges arise from their Senate testimony about the company's involvement in the 1970 Chilean presidential election.

Mar. 23—President Carter signs an executive order directing that federal regulations be written in "plain English."

Mar. 27—President Carter proposes a new policy for urban recovery; he proposes new job programs, tax incentives, 160 changes in 38 existing programs to make them more sensitive and public works and grants, all aimed at the recovery of the nation's ailing cities; the proposals have been submitted to Congress.

Mar. 29—Vice President Walter Mondale proposes administration plans for higher wheat subsidies and land diversion funds for farmers.

Apr. 3—The Office of Inspector General reports that because of waste, fraud and abuse the Department of Health, Education and Welfare misspent between \$6.3 billion and \$7.4 billion in fiscal 1977.

Apr. 11—President Carter tells the annual meeting of the American Society of Newspaper Editors that government, industry and labor must "sacrifice for the common good" and coordinate their struggle against inflation. He

proposes holding federal white-collar salary increases to 5.5 percent in 1978.

Apr. 12—Joseph Califano, Jr., Secretary of HEW, announces new steps to help control "the precipitous and corrosive rise in the cost of medical care in America."

Apr. 14—President Carter suggests that Congress establish a Department of Education.

Apr. 21—The Postal Administration votes tentatively, 3 to 1, to raise first class letter postage from 13¢ to 15¢.

Apr. 25—The President says his proposed \$25-billion tax cut is not inflationary.

Apr. 27—President Carter supports a proposed \$500-million program for the improvement of mental health care.

The President acts to strengthen the White House Office of Consumer Affairs.

Cecil D. Andrus, Secretary of the Interior, reports that there is no evidence that oil companies have withheld production of natural gas from offshore leases.

Civil Rights

Mar. 2—Rhode Island Governor J. Joseph Garrahy announces an agreement that will return 1,800 acres of state and private land to members of the Narragansett Indian tribe. The members of the tribe have contended that the land was taken from them illegally over 100 years ago.

Mar. 8—Secretary of Health, Education and Welfare Joseph Califano, Jr., announces agreement with the state of Georgia on plans to desegregate the state's colleges.

Mar. 24—Federal district Judge Walter Skinner dismisses a suit by the Wampanoag Indian tribe which claimed 11,000 acres of the Cape Cod town of Mashpee; the judge upholds a jury decision which said that the Indians did not constitute a tribe in the legal sense at the relevant dates in their history.

Economy

Mar. 1—The Commerce Department reports that construction in January declined 4 percent.

Mar. 3—The Commerce Department reports that the U.S. had a \$2.38-billion trade deficit for the month of January.

Mar. 9—The Labor Department reports that the wholesale price index for January rose 1.1 percent.

Mar. 10—The Labor Department reports that the unemployment rate fell to 6.1 percent in February.

Mar. 28—The Labor Department reports a 0.6 percent rise in the consumer price index for February.

Mar. 30—The Commerce Department reports no change in its index of leading economic indicators for the month of February.

Mar. 31—The Commerce Department reports a record \$4.52-billion trade deficit in the month of February.

Apr. 7—The Labor Department reports that unemployment rose from 6.1 percent in February to 6.2 percent in March.

Apr. 8—An Agriculture Department and Census Bureau report reveals that the farm population in the U.S. declined 5.4 percent in 1977.

Apr. 19—The Commerce Department reports that the 1978 first quarter output of goods and services declined 0.6 percent.

The administration announces plans to sell 300,000 ounces of gold a month for 6 months; the international value of the dollar begins to rise and gold prices drop.

Apr. 26—The Commerce Department reports that the U.S. trade deficit declined to \$2.8 billion in March, a drop from the record February deficit of \$4.5 billion.

Apr. 28—The Department of Labor reports that the consumer price index rose 0.8 percent in March; the annual rate of inflation for the 1st quarter of 1978 was 9.3 percent.

The Chase Manhattan Bank and other major banks raise their prime lending rate to 8.25 percent.

Foreign Policy

(See also *Intl, Arms Control, Middle East, Cambodia; Nigeria*)

Mar. 1—The U.S. dollar falls to 1.9920 marks to the dollar, the 1st time the dollar has fallen below 2 marks to the dollar.

Mar. 2—President Jimmy Carter receives Kenyan Vice President Daniel Arap Moi at the White House and assures him that "we . . . will make arrangements to guarantee you have adequate defense capabilities."

Mar. 4—Under Secretary of State for Political Affairs Philip Habib resigns the number 3 job at the State Department for reasons of health.

Mar. 8—Israeli Defense Minister Ezer Weizman meets with Defense Secretary Harold Brown to discuss Israeli arms requirements.

Mar. 13—Secretary of the Treasury W. Michael Blumenthal and West German Finance Minister Hans Miethofer agree on a joint plan to help stabilize the dollar; West Germany will make \$2.74 billion in marks available to buy dollars if necessary.

Mar. 17—In a speech in Winston-Salem, North Carolina, President Carter warns the Soviet Union that the recent growth of Soviet military strength imperils U.S.-Soviet cooperation; he also warns that the U.S. is prepared to increase its military arsenal if necessary.

Mar. 22—President Carter and Israeli Prime Minister Menahem Begin end 2 days of talks in Washington, D.C., that fail to resolve problems between Israel and the U.S.

Mar. 23—British Prime Minister James Callaghan meets with President Carter in Washington, D.C.

Mar. 24—At a news conference in Washington, D.C., Secretary of State Cyrus Vance says that although there are "substantial obstacles" because of differences with Israeli Prime Minister Begin, "the United States will persevere" in the cause of peace in the Middle East.

Mar. 28—President Carter begins a 4-nation trip to Venezuela, Brazil, Nigeria and Liberia; he arrives in Caracas, Venezuela, to confer with Venezuelan President Carlos Andrés Pérez.

Mar. 29—President Carter arrives in Brasilia, Brazil; in a speech at the airport he mentions both human rights and nuclear nonproliferation, problems about which Brazil and the U.S. have disagreed.

Mar. 31—President Carter arrives in Lagos, Nigeria; he meets with Nigerian leader General Olusegun Obasanjo; after Saudi Arabia, Nigeria is the largest supplier of oil to the U.S.

Apr. 1—In Nigeria, President Carter says his administration is pledged to an Africa "free from colonialism, racism and military interference by outside nations."

Apr. 3—In Liberia, the President warns South Africa not to reject a Western-supported U.N. proposal to bring majority rule to South-West Africa (Namibia).

The State Department says the President will ask Congress to end the 3-year-old arms embargo against Turkey.

Apr. 5—Secretary of State Vance says that in southern Lebanon Israel may have violated her pledge to the U.S. not to use American military equipment; he says no action is planned against Israel.

Apr. 11—President Carter welcomes Romanian President Nicolae Ceausescu to the White House.

Apr. 12—Vance leaves for a mission to southern Africa and the U.S.S.R.

Apr. 19—The White House announces that Vice President Walter Mondale will leave for the Far East April 29. Vance arrives in Moscow.

Apr. 20—The U.S. Trust Territory of the Pacific Islands and the U.S. reach an agreement on the future status of the Trust Territory; the agreement was worked out April 9 in Hawaii.

The Nuclear Regulatory Commission blocks the U.S. sale of enriched uranium to India.

Apr. 21—The President announces that he will withdraw one combat battalion from Korea in 1978; 2 other battalions formerly scheduled to be withdrawn will be left there until 1979.

Apr. 25—At a news conference, the President says it is in "the best interests of our own nation" to sell planes to Israel, Saudi Arabia and Egypt as a package.

Apr. 26—In Washington, D.C., Israeli Foreign Minister Moshe Dayan confers with Secretary of State Vance.

Apr. 27—Overruling an order of the Nuclear Regulatory Commission, the President orders the sale of more than 8 tons of enriched uranium to India for a U.S.-built nuclear power reactor.

Labor and Industry

Mar. 3—The United Mine Workers start to vote on a proposed settlement of their 88-day strike.

Mar. 5—Miners reject a proposed strike settlement by a 2-to-1 margin.

Mar. 6—President Carter invokes the compulsory back-to-work provisions of the Taft-Hartley Act; the President says he will "take steps to see that all parties resume negotiations as rapidly as possible."

Mar. 9—Attorney General Griffin Bell obtains a back-to-work order, under provisions of the Taft-Hartley Act, from federal Judge Aubrey Robinson, Jr.

Mar. 13—Most miners ignore the back-to-work order.

Mar. 16—Judge Robinson extends his restraining order while a new proposed contract between the United Mine Workers and the coal operators is considered.

Mar. 24—Some 60 percent of the nation's coal miners approve a new contract.

Mar. 27—Most miners return to work after being on strike for 112 days.

Mar. 29—U.S. Steel Corporation increases its prices by 2.2 percent or \$10.50 a ton.

Apr. 3—The U.S. Steel Corporation says it will roll back its price hike of \$10.50 a ton on most products, in response to administration pressure and to competition.

Apr. 4—Pan American World Airways says it has decided to buy 12 jumbo jet airliners from the Lockheed Aircraft Corporation in a \$500-million deal.

Apr. 13—The U.S. International Trade Commission decides 4 to 0 that imports of carbon steel plate from Japan are damaging U.S. steel companies; thus the Treasury can set new tariffs on carbon steel plate.

Legislation

Mar. 3—By a voice vote, the Senate confirms William Miller as chairman of the Federal Reserve Board.

Mar. 16—The Senate votes 68 to 32 to approve the 1st Panama Canal Treaty.

Mar. 23—The Senate votes 62 to 10 to approve a bill raising the mandatory retirement age to 70; college professors and certain business executives are not included. The

House passed the bill earlier in the week; it now goes to President Carter.

Mar. 25—President Jimmy Carter signs a bill authorizing the expenditure of \$90 million over 3 years for land acquisition and the protection of the Appalachian Trail.

Mar. 27—President Carter signs a bill adding to and protecting the Redwood National Park.

Apr. 6—The President signs the bill raising the legal mandatory retirement age for most employees to age 70. The law amends the Age Discrimination in Employment Act.

Apr. 12—The House votes 268 to 150 to defeat a controversial emergency farm aid bill the President had promised to veto as inflationary.

Apr. 18—The Senate ratifies the 2d Panama Canal Treaty, voting 68 to 32; the U.S. will turn the Panama Canal over to Panama by the year 2000.

Apr. 20—3 senior Democrats on the House Ways and Means Committee warn the President that his proposed tax reform bill will not be accepted.

The President strongly urges Congress to enact his energy program.

Apr. 21—House and Senate conferees reach an agreement on natural gas pricing, a crucial step in their effort to enact energy legislation.

Military

Apr. 2—It is reported in Washington, D.C., that Secretary of State Vance has written to the President asking him to expedite an Arms Control and Disarmament Agency proposal for an international ban on the production of materials used in nuclear weapons.

Apr. 6—It is reported from Washington, D.C., that in a secret memorandum to the President, Defense Secretary Harold Brown reported that the U.S. needs stronger air defenses.

Apr. 7—President Carter announces that he has "decided to defer production" of the controversial neutron bomb, a high-radiation warhead.

Political Scandal

Mar. 14—South Korean businessman Tongsun Park appears before the Senate Ethics Committee.

Mar. 31—Former Representative Otto Passman (D., La.) is indicted by a federal grand jury for conspiring with Tongsun Park and for accepting bribes from him.

Apr. 3—Beginning his testimony before the House Ethics Committee, Tongsun Park says he distributed \$850,000 in gifts and campaign contributions to President Richard Nixon's reelection committee and to congressmen and former congressmen and unsuccessful candidates for the House.

Apr. 8—Hancho C. Kim, a Korean-born businessman, is convicted by a federal jury of conspiring to bribe congressmen and of lying about this under oath.

Apr. 10—A federal grand jury charges L. Patrick Gray 3d, former FBI acting director, and 2 other executives of the FBI of conspiring to deprive Americans of their civil rights by ordering illegal entries to their homes.

Apr. 14—The Department of Justice says that regulations for granting public access to former President Richard Nixon's papers and tapes were adopted in an unconstitutional manner.

Apr. 20—In federal district court, Gray pleads not guilty to felony charges.

Apr. 24—Former congressman Richard T. Hanna (D., Cal.) is sentenced to prison for conspiring to defraud the U.S. in the Korean influence-buying scandal.

Apr. 26—The Securities and Exchange Commission and the Comptroller of the Currency charge that former Bud-

get Director Bert Lance is guilty of civil fraud and other violations of federal law.

Supreme Court

Mar. 6—In a 6 to 3 vote, the Supreme Court rules that states do not have a constitutional right to bar large supertankers from their waters.

Mar. 28—By a 5 to 3 majority, the Court rules that judicial immunity is broad enough to protect a judge from a damage suit even in the event of "grave procedural error. . . ." The case involved the sterilization of a 15-year-old girl in Indiana.

Mar. 31—By a 5 to 4 vote, the Court rules that cities can be fined and prosecuted for violations of federal antitrust laws in the same manner that corporations can be punished; the case involves 2 small Louisiana cities.

Apr. 3—The Supreme Court rules unanimously that federal judges cannot try to revise congressional policy decisions by imposing on government agencies procedural requirements that make those policies almost unmanageable; the cases involve future nuclear installations in Vermont and Michigan. The cases are still to be resolved in the lower courts.

Apr. 11—Former Secretary of State Henry Kissinger asks Chief Justice Warren Burger to help him in his efforts to keep his phone conversations as Secretary of State secret until after the year 2000.

Apr. 18—The Court rules 7 to 2 that the television networks have no constitutional right enforceable in the courts to reproduce and circulate the White House tapes about the Watergate scandal that led to the resignation of President Richard Nixon.

Apr. 19—The Court rules unanimously that priests and ministers cannot be constitutionally prohibited from running for public office; the case involves a provision of the Tennessee constitution.

Apr. 24—The Court denies Patricia Hearst's request for a review of her conviction for taking part in a bank robbery in San Francisco in April, 1974.

Apr. 25—The Court rules 6 to 2 that charging women more than men to participate in a pension plan constitutes illegal sex discrimination.

The Court rules that the National Society of Engineers' prohibition against competitive bidding between members is a violation of antitrust laws.

Apr. 26—The Court rules 5 to 4 that a Massachusetts law barring corporations from spending money to finance propaganda for or against referendum ballot propositions is unconstitutional.

Supreme Court Chief Justice Burger says that "large media conglomerates" have no special claim on constitutional liberties.

VENEZUELA

(See U.S., Foreign Policy)

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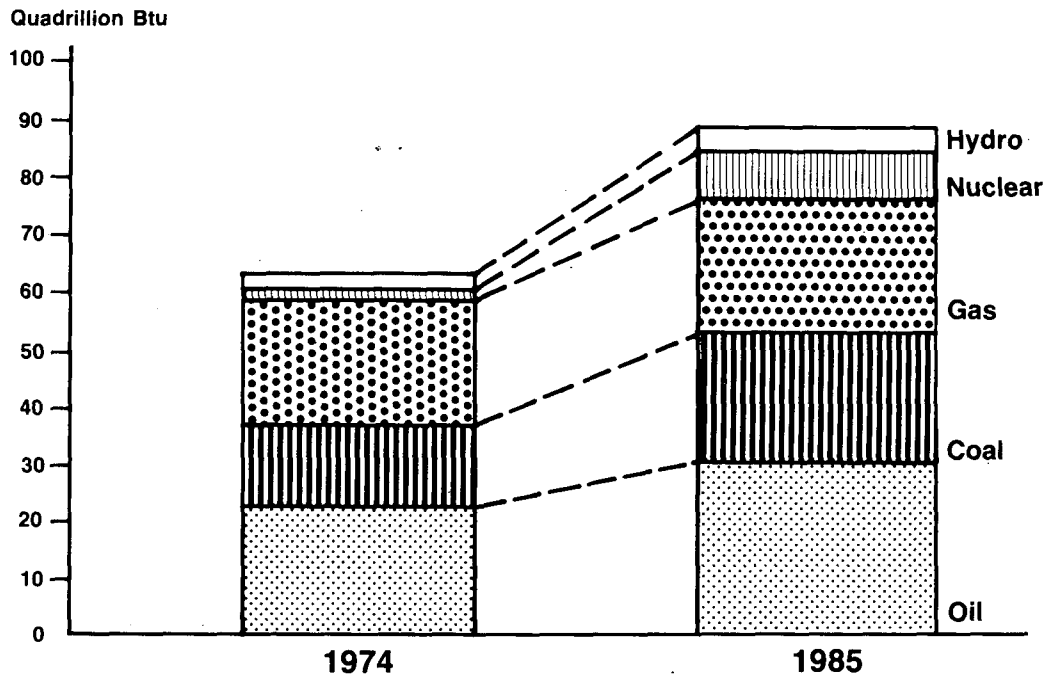
Mar. 7—In Washington, D.C., President Tito meets with U.S. President Jimmy Carter; they reportedly discuss the crises in the Horn of Africa and the Middle East.

Mar. 10—Tito arrives in London for talks with British Prime Minister James Callaghan.

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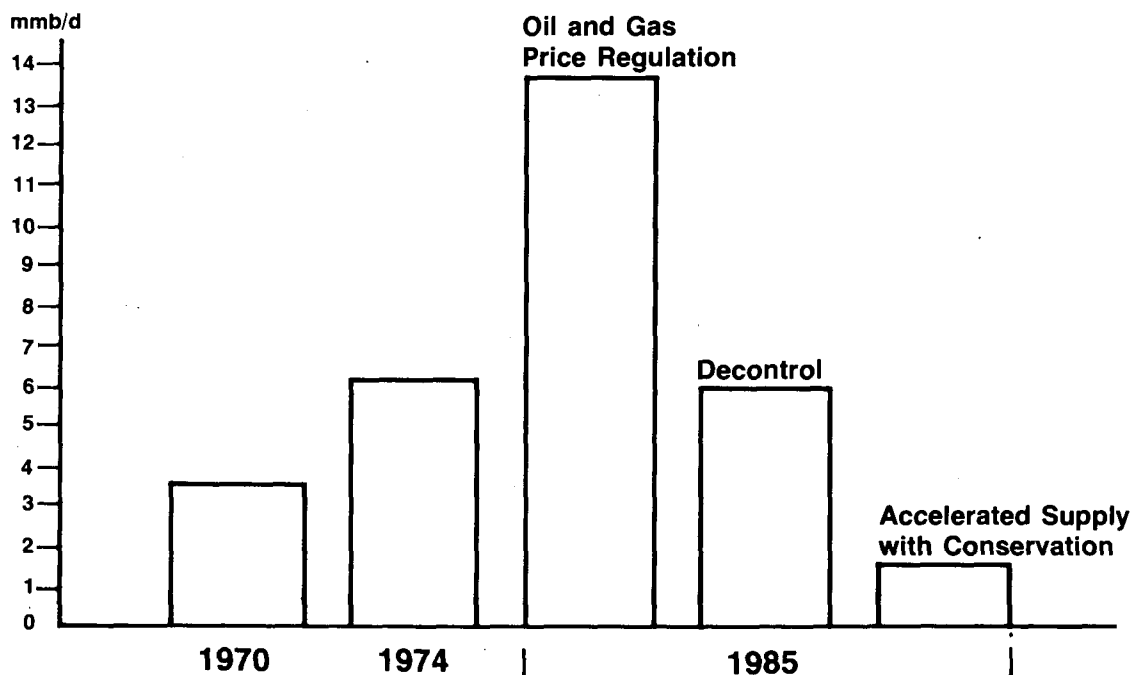
Mar. 17—13 people found guilty by a military tribunal for taking part in the attempted assassination of President Mobutu Sese Seko in February are executed. ■

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